☑ Fact-Checked Science

PAPER CHECK · MAGNETIC FIELDS AND THE BODY

Six volunteers in a near-zero field: faster hearts, and reactive oxygen never measured

A Research Square preprint put the six-person crew of a 366-day Moon-mission simulation into a coil system that cut the local magnetic field 350-fold, to 143 nT, for four hours before the isolation and four hours near its end, and recorded heart rate, blood pressure, heart-rate variability and skin blood flow on the forehead [1 pp. 3–5]. S0 News labelled its link to the paper "Hypomagnetic ROS" in the episode's description and said the trio of papers it belonged to "all hit the wild surge in reactive oxygen species" [2 2:19]. The preprint measured no reactive oxygen species: its one sentence on oxidative stress is a suggestion drawn from other work [1 pp. 2, 7]. We checked what it measured, what its authors suggest and what the episode made of it, keeping the three apart.

By Fact-Checked Science · Published October 21, 2026

OUR ANALYSIS marks our own reasoning and calculations, and the verdicts are our assessment. Everything else comes from the numbered sources; for the preprint [1], p. gives the page number printed in its footer, Fig. one of its five figures or a panel, and Table 1 its only table.

A hedged preprint about blood flow, recast as a surge of reactive oxygen

OUR ASSESSMENT

6

volunteers, 2 men and 4 women, each compared with their own background recording. There was no sham session [1 pp. 3–4].

2 × 4 h

hypomagnetic exposures per person: one 2–4 days before a 366-day isolation and one on its days 346–350 [1 p. 4][1 Fig. 2].

3

asterisks in Table 1: the paper's only marks of statistical significance, on heart rate twice and systolic pressure once [1 Table 1].

THE CLAIMS

MISREAD

The paper is one of a trio that "all hit the wild surge in reactive oxygen species"

S0 News, October 20, 2026 [2 2:19]

The preprint measured no reactive oxygen species and took no blood: its instruments were an ECG, a pressure cuff and a laser Doppler probe on the forehead [1 pp. 4–5]. Its one sentence on the subject is a suggestion drawn from other papers: "The obtained data suggest a potential increase in oxidative stress" [1 p. 2]. See section 3.

MISREAD

"The chemical army in your blood isn't working right"

S0 News, October 20, 2026 [2 2:41]

The study is about the control of blood flow, not what blood is made of. It recorded heart rate, blood pressure, heart-rate variability and oscillations in skin blood flow; no blood sample was taken, and nothing in it speaks to immune cells, antioxidants or blood chemistry [1 pp. 4–6]. See section 1.

UNSUPPORTED

"These effects are compounding the longer the situation unfolds"

S0 News, October 20, 2026 [2 2:45]

Each volunteer had two four-hour exposures, one before the 366-day isolation and one on its last days; no dose or duration was varied [1 p. 4][1 Fig. 2]. The year between the sessions was spent at the ordinary field, so a larger change in the second session cannot be told apart from a year of confinement [1 p. 4]. See section 4.

FALSE

The lab field is "low field strength like we're entering as Earth's magnetic field is tanking"

S0 News, October 20, 2026 [2 2:13]

The unit held 143 ± 32 nT, about 350 times below the local field [1 p. 4]. Earth's surface field today is roughly 160–470 times stronger than that [3 Table 1], and even the Laschamp excursion's low, about 2–5% of today's dipole, would leave a field some 7–17 times stronger than the unit's (our analysis) [4 §4.2][5 §3]. The paper never mentions Earth's field changing. See section 5.

OVERSTATED

Hypomagnetic conditions "trigger activation of the sympathoadrenal system and alter microcirculation regulatory mechanisms"

The preprint's abstract [1 p. 2]

Heart rate rose significantly in both sessions and systolic pressure in one; those three asterisks are the paper's only reported significance tests [1 Table 1]. The heart-rate-variability and skin-blood-flow changes are reported as directions with no test [1 Figs. 3–4], in six people, with no sham session and no blinding [1 pp. 4–5]. The paper's own conclusion retreats to "it can be assumed … probably" [1 p. 8]. See section 2.

1 · THE EXPERIMENT

Six people, a coil system and two four-hour sessions a year apart

The volunteers were the crew of SIRIUS-23, the fourth isolation experiment of the SIRIUS programme at the Institute of Biomedical Problems in Moscow: 366 days sealed in a ground-based complex that simulated a Moon mission [1 p. 3]. The magnetic field was lowered only inside the "Arfa" exposure unit, for four hours at a time [1 p. 4].

The volunteers

Six healthy volunteers, 2 men and 4 women, aged 25 to 37 [1 p. 3]. The isolation simulated a flight to a lunar orbital station (days 1–4), a stay there (days 5–361), five surface landings by four of the crew and a return to Earth (days 362–366) [1 p. 3][1 Fig. 2]. The complex reproduces the main factors of spaceflight "with the exception of weightlessness and radiation exposure" [1 p. 3]; everywhere in it except the exposure unit, the magnetic field was left as it was [1 p. 4].

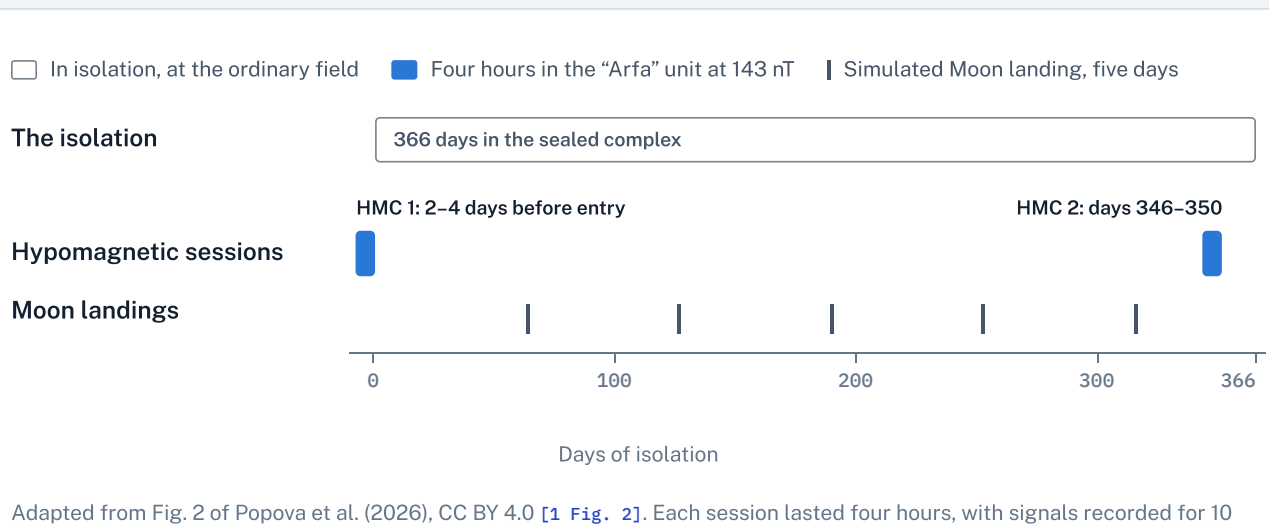
A companion paper by the same group, now peer reviewed, reports how these six responded to the isolation itself [6].

The "Arfa" unit and its field

Coaxial current-carrying coils (Helmholtz rings) drive a field opposed to Earth's, cancelling it inside a movable box [1 p. 4]; the system was described in an earlier paper on 8-hour exposures [7]. The field inside was 143 ± 32 nT, monitored with a three-component magnetic sensor, and the paper gives the reduction as 350-fold [1 p. 4].

An earlier study by the group on six men, which its authors call a pilot, tested 350-, 650- and 1000-fold reductions over 32 hours of ECG and found the response "quite pronounced" already at 350-fold in one of the two groups of volunteers it identified [8].

When the field was lowered



Adapted from Fig. 2 of Popova et al. (2026), CC BY 4.0 [1 Fig. 2]. Each session lasted four hours, with signals recorded for 10 minutes before the unit was switched on and for the last 10 minutes before it was switched off; in the second session two people were exposed per day [1 pp. 4–5].

The paper describes its baseline two ways: as background studies made "before placing the examinees in the installation" and as the 10 minutes before the unit was switched on [1 pp. 4–5]. Which recording the "Before" and "Isolation" columns of its Table 1 report is not stated unambiguously.

What was measured, from macro to micro

Macroscale: the central circulation

An ECG with heart-rate-variability analysis (Varicard 2.8, standard lead II), giving MxDMn, the spread between the longest and shortest beat intervals; pNN50, the share of successive beat intervals that differ by more than 50 ms; and the high- and low-frequency spectral powers HF and LF, which the authors read as parasympathetic and sympathetic activity. Blood pressure was taken with an automatic cuff [1 pp. 4–5].

Microscale: skin blood flow on the forehead

Laser Doppler flowmetry (LAZMA-PF) at one site, the glabella between the eyebrows. The software splits the flow signal into oscillations attributed to the endothelium, to sympathetic nerves, to breathing (venular) and to the pulse, and reports each band's amplitude; its spectral-power shares cover the endothelial and neurogenic bands and a fifth, myogenic band (P_M), for which no amplitude is reported [1 p. 5][1 Fig. 4]. "Microscale" means these skin microvessels, not cells or anything inside them.

OUR ANALYSIS

What was not measured

No blood sample was taken. Nothing was measured on reactive oxygen species or any marker of oxidative stress, on the brain, cognition or behaviour, on mitochondria, or on any lymphatic or waste-clearing system [1 pp. 4–5]. "Brain", "cognition", "locus coeruleus" and anything lymphatic do not appear in the paper at all; "mitochondrial" and "hippocampal neurogenesis" appear only inside the titles of other people's papers in its reference list, and the mitochondrial one is about mouse muscle [1 pp. 10–11]. "Reactive oxygen species" and "oxidative stress" appear only in the authors' suggestion, in the abstract, the Discussion, the conclusion and the scheme of Figure 5, and in one cited title [1 pp. 2, 7–8][1 Fig. 5][1 p. 12].

2 · WHAT THE NUMBERS SHOW

Three asterisks, then directions without a test

Because the data failed a normality check, the paper used paired Wilcoxon tests at p < 0.05 [1 p. 5]. It reports no p-value anywhere; its only marks of significance are three asterisks in Table 1 [1 Table 1]. Figures 3 and 4 carry none.

HEART RATE, SESSION 1

56.8 → 71.3

beats per minute, medians before the isolation and in the last 10 minutes of four hours in the unit; marked significant [1 Table 1]

HEART RATE, SESSION 2

52.1 → 69.1

beats per minute, medians at the end of the isolation and in the last 10 minutes of four hours in the unit; marked significant [1 Table 1]

SYSTOLIC PRESSURE, SESSION 2

94 → 118

mmHg, marked significant. The session-1 rise (101 → 109) and both diastolic rises (64 → 69 and 59 → 77) are not marked [1 Table 1]

The preprint's Table 1: central hemodynamics, as the paper reports it

MEASURE	BEFORE	HMC 1	ISOLATION	HMC 2
Heart rate (bpm)	56.83 (51.60; 62.92)	71.25 (66.66; 74.70)*	52.11 (50.38; 61.17)	69.12 (68.69; 69.80)*
Systolic pressure (mmHg)	101 (96; 107)	109 (107; 111)	94 (86; 100)	118 (116; 123)*
Diastolic pressure (mmHg)	64 (56; 73)	69 (67; 72)	59 (55; 62)	77 (68; 84)

Medians with lower and upper quartiles; the original prints decimal commas. "Before" and "Isolation" are the background recordings, HMC 1 and HMC 2 the two exposures. The asterisk is the paper's: "significant difference from background studies, p<0.05" [1 Table 1]. The results text calls this "a slight increase in HR and blood pressure" [1 p. 6].

OUR ANALYSIS

With six pairs, significance needs all six to move the same way

A paired Wilcoxon signed-rank test on six people can reach p < 0.05 only when every one of the six changes in the same direction: the exact two-sided p-value is then 0.031, and the next value the test can produce, with one person going the other way, is 0.063. So each asterisk in Table 1 means that all six volunteers moved together, and no result in this design could have come out significant otherwise. A rise of 14 and 17 beats per minute in median heart rate is a large change for four hours spent in the unit. The paper mentions no correction for the eleven or more indices it examined [1 p. 5].

Heart-rate variability and skin blood flow: directions only

What the paper reports

MxDMn and pNN50 fell in both exposures and the low-frequency power LF rose, which the authors read as less parasympathetic and more sympathetic drive [1 p. 5][1 Fig. 3]. On the forehead, the endothelial and neurogenic amplitudes rose while the venular and pulse amplitudes fell [1 p. 6][1 Fig. 4]. Each is shown as a median with an interquartile range and, for the amplitude panels, the six individual points, and none carries a test [1 Figs. 3–4].

OUR ANALYSIS

Two things in the figures that don't add up

The spectral-power shares in Figure 4F are plotted as percentages, yet they sum to roughly 44%, 86%, 7% and 76% across the four conditions; the near-zero "Isolation" background is the comparator for the HMC 2 bars, and the paper does not say what the shares are of [1 Fig. 4F].

The Discussion argues from "an increase in the amplitude of venular oscillations" [1 p. 7], while the abstract, the results and Figure 4C all report a decrease [1 p. 2][1 Fig. 4C].

How the authors explain it

Their Figure 5 is a drawn scheme, not data: a parasympathetic column with falling venular oscillations, pNN50, MxDMn and HF power, a sympathetic column with predominant neurogenic oscillations, rising LF power and "oxidative stress → ↑ROS → ↑endothelial oscillations", and underneath, rising heart rate and blood pressure with falling pulse fluctuations [1 Fig. 5]. The text proposes that a stronger pulse wave raises vascular tone, cutting the pulse amplitude in the skin and the flow of arterial blood to the capillaries, "which is likely due to the activation of the sympathoadrenal system" [1 pp. 7–8]. Two items on the scheme go beyond the results: diastolic pressure never reached significance, and HF power was not tested [1 Table 1][1 Fig. 3C].

3 · THE REACTIVE-OXYGEN QUESTION

Oxidative stress is a suggestion in the Discussion, not a measurement

The preprint's one paragraph on reactive oxygen species (ROS) cites other people's work and reasons from it [1 p. 7]. Here is the chain, link by link, from what was measured to what the episode called a "wild surge".

1 · WHAT WAS MEASURED

A skin oscillation rose

The amplitude of endothelial oscillations in forehead skin blood flow was higher during both exposures, as read from a figure with no test [1 Fig. 4A].

2 · WHAT THE AUTHORS INFER

So ROS probably rose

"It is logical that the likely increase in ROS contributed to the activation of endothelial cells," they write, which "influenced the production of NO" and raised the endothelial amplitude [1 p. 7]. No ROS, nitric oxide or endothelial marker was measured [1 pp. 4–5].

3 · WHAT THEY CITE

A review in Russian, and another review

A 2022 Russian-language review, which they say showed that red blood cells in a weakened field "produced more reactive oxygen species" [1 p. 7][9], and a 2020 review proposing ROS as signalling molecules in hypomagnetic fields [10]. The 2022 review could not be obtained: its publisher's site did not respond.

4 · WHAT LIES BEHIND IT

Rat red cells in a dish, with an oxidant added

Three of the review's authors ran the primary experiments we could trace: rat erythrocytes in vitro, dosed with tert-butyl hydroperoxide, with effects that depended on the dose and the incubation time [11][12]. Linking the review to those experiments is our inference.

In the authors' words

HMC is the paper's abbreviation for hypomagnetic conditions, GMF for the geomagnetic field and CVS for the cardiovascular system.

> *"The obtained data suggest a potential increase in oxidative stress under reduced geomagnetic field conditions, which may pose health risks during long-duration spaceflights."*
>
> The abstract [1 p. 2]

> *"HMC can enhance the effects of oxidative stress. This is evidenced by the results of a study (Shchegolev et al. 2022), which showed that red blood cells exposed to a weakened magnetic field produced more reactive oxygen species than red blood cells exposed to a normal magnetic field."*
>
> The discussion [1 p. 7]

> *"Thus, it can be assumed that in the conditions of HMC, there is probably a modification of the mechanisms of regulation of the CVS … In addition, it is worth noting that HMC can enhance the effects of oxidative stress, which also represents a potential risk in the case of a significant decrease in GMF."*
>
> The conclusion [1 p. 8]

OUR ANALYSIS

Even the animal work does not run one way

The best-known mouse study of near-zero fields found that new neuron growth in the hippocampus was impaired together with a *reduction* in reactive oxygen species in neural stem cells, and that raising ROS restored it [13][14]; a follow-up by the same group examined the cells around them [14]. A "wild surge" is not what that work reports, and this preprint reports no ROS at all. Its authors do hedge, with "suggest", "potential", "likely" and "can" [1 pp. 2, 7–8]; the episode dropped the hedges.

4 · WHAT THE EPISODE SAID

A "triple on hypomagnetic fields", summed up as if all three measured the same things

S0 News presented the preprint with two other papers as "a triple on hypomagnetic fields" and described them together [2 2:13–3:02]. The presenter did say "Each looks at different subjects, different specific markers" [2 2:28]; the rest of the passage treats them as one finding. Here is each statement against this paper. The other two papers have their own pages.

THE EPISODE SAYS	WHAT THE PREPRINT SHOWS	OUR VERDICT
"Up next we've got a triple on hypomagnetic fields. Low field strength like we're entering as Earth's magnetic field is tanking." [2 2:13]	The unit held 143 ± 32 nT, 350 times below the local field [1 p. 4]. Earth's surface field is 23–67 μT, roughly 160–470 times stronger [3 Table 1]; a Laschamp-sized excursion low would still be 7–17 times stronger than the unit (our analysis, section 5). The paper says nothing about Earth's field changing [1 pp. 2–3].	FALSE Today's field is 160–470 times stronger, and even a Laschamp-sized low would be seven times stronger.
"all hit the wild surge in reactive oxygen species" [2 2:19]	No reactive oxygen species were measured. The abstract offers "a potential increase in oxidative stress" as a suggestion, and the Discussion reasons to it from other papers [1 p. 2][1 p. 7].	MISREAD A real paper, with no such measurement in it.
"and brain impact, neurogenesis, hippocample activity, and the locus curerilius … all showed that when you take away the magnetic field, the brain stops working right. The mitochondria aren't working right. The waste removal system isn't working right." [2 2:13–2:45]	None of these was measured here: no brain, cognition or behaviour, no mitochondria, no lymphatic or glymphatic measure [1 pp. 4–5]. "Brain", "cognition" and "locus coeruleus" appear nowhere in the paper; "mitochondrial" and "hippocampal neurogenesis" appear only inside the titles of other people's papers in its reference list [1 pp. 10–11]. ("Hippocample" and "locus curerilius" are the transcript's renderings of hippocampal and locus coeruleus.)	CONTEXT "All" is wrong here too. But the episode tied this paper to reactive oxygen by its own link label, while the brain, mitochondrial and waste-clearance measures belong to the other two papers, so we rate those on their pages and in the episode review.
"Each looks at different subjects, different specific markers" [2 2:28]	This one studied six human volunteers with heart-rate variability, blood pressure and skin laser Doppler flowmetry [1 pp. 3–5].	TRUE Different subjects and different markers, as said.
"The chemical army in your blood isn't working right." [2 2:41]	No blood was sampled and no blood chemistry measured. The study is about the regulation of blood flow: heart rate, blood pressure, beat-to-beat variability and oscillations in skin perfusion [1 pp. 4–6].	MISREAD Blood flow control, not blood constituents.
"And these effects are compounding the longer the situation unfolds." [2 2:45]	Two four-hour exposures per person, a year apart, with no duration or dose arm [1 p. 4][1 Fig. 2]. The review the paper itself cites found that across the literature, hypomagnetic effects show no statistical correlation with the type or duration of exposure [15].	UNSUPPORTED The design cannot speak to duration, and the review it cites found no such trend.
"I'm sure it's just a coincidence that America is losing protection from Earth's magnetic field the fastest in this ongoing pole shift. And we appear to be losing our damn minds." [2 2:47–3:02]	The paper says nothing about regions, pole shifts or Earth's field changing; its frame is spaceflight [1 pp. 2–3]. The regional claim belongs to our review of the episode.	CONTEXT Not a claim about this paper.

How we rated

We rated each statement as a statement about this preprint, on our standard scale, and the preprint's own claims against its own data. Where a statement is about the other papers in the trio rather than this one, we mark it Context and say so.

TRUE	The evidence supports the claim.
MISREAD	Cites a real source but gets wrong what it says.
UNSUPPORTED	No evidence we could find backs it up, though it hasn't been strictly disproven.
FALSE	The evidence contradicts the claim.
OVERSTATED	Has some basis but claims much more than the evidence supports.
CONTEXT	A question or aside rather than a claim. We add the facts it leaves out.

The preprint's other claims, against its own data

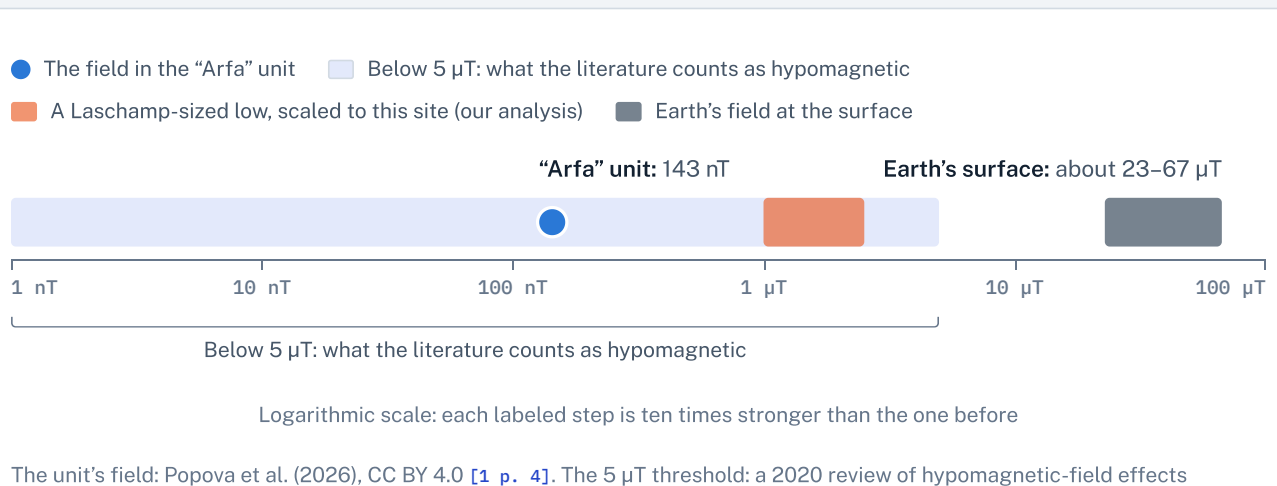
THE PREPRINT SAYS	WHAT ITS DATA SHOW	OUR VERDICT
"Under HMC, a decrease in parasympathetic activity (reduced pNN50 and MxDMn values), an increase in sympathetic activity, and elevated heart rate and blood pressure were observed." [1 p. 2]	Heart rate: significant in both sessions. Systolic pressure: significant in session 2 only. Diastolic pressure: never marked. pNN50, MxDMn and LF: the direction described, with no test [1 Table 1][1 Fig. 3].	PARTLY TRUE Heart rate holds; blood pressure in one session, systolic only; the rest is untested.
"At the level of skin microcirculation an increase in the amplitude of endothelial and neurogenic oscillations was noted, alongside a decrease in the amplitude of venular and pulse oscillations." [1 p. 2]	Figure 4 shows those directions in both sessions, at one skin site, in six people, with no test and no correction [1 Fig. 4]. The Discussion then argues from an increase in venular amplitude [1 p. 7].	UNCONFIRMED A consistent but untested preliminary pattern.
"The obtained data suggest a potential increase in oxidative stress under reduced geomagnetic field conditions, which may pose health risks during long-duration spaceflights." [1 p. 2]	Nothing in the data bears on oxidative stress; the suggestion rests on the chain in section 3 [1 p. 7].	UNSUPPORTED Fairly hedged, but no measurement stands behind it.

Two more verdicts used here: PARTLY TRUE means part of the claim holds up and part doesn't, and UNCONFIRMED that it rests on a preliminary result that hasn't been confirmed.

5 · HOW WEAK IS 143 NT?

About 350 times below Earth's field, and far below any excursion low

The unit's 143 nT is about 0.3% of a typical surface field. The paper never compares it with Earth's past or future; its frame is spaceflight, where the field falls away with distance from Earth and "the members of space crews will be in an evolutionarily atypical HMC" [1 p. 3].



The unit's field: Popova et al. (2026), CC BY 4.0 [1 p. 4]. The 5 μT threshold: a 2020 review of hypomagnetic-field effects [10 Abstract]. Earth's surface field: the World Magnetic Model report [3 Table 1]. The excursion band is our scaling of a local field of about 50 μT by the Laschamp low's 2–5% of today's dipole [4 §4.2][5 §3][16 p. 7].

INSIDE THE "ARFA" UNIT

143 nT

give or take 32 nT; the paper gives the reduction as 350-fold [1 p. 4]

AT EARTH'S SURFACE

23–67 μT

the field's approximate range around the globe [3 Table 1]

EARTH'S FIELD IS STRONGER BY

OUR ANALYSIS

160–470×

roughly: 23,000 nT ÷ 143 nT ≈ 160; 67,000 nT ÷ 143 nT ≈ 470. A 350-fold reduction to 143 nT implies a local field of about 50 μT, inside that range.

What the paper says about Earth's field

Nothing about pole shifts, excursions or a weakening field. The word "reversal" occurs once, in the title of a cited perspective piece [1 p. 11][17]. The conclusion's "potential risk in the case of a significant decrease in GMF" names no place, mechanism or timescale [1 p. 8]; the introduction frames the question around crews beyond low Earth orbit [1 p. 3].

OUR ANALYSIS

Even an excursion would leave a far stronger field

Earth's axial dipole is about 9% weaker than it was in 1840 [18 p. 1]. At the Laschamp excursion's low, about 41,000 years ago, global field models put the dipole at roughly 2–5% of today's [4 §4.2][5 §3][16 p. 7]. Scale a local field of about 50 μT by that and you get 1,000–2,500 nT, still 7 to 17 times the field in the unit. The comparison is rough: excursion models describe the global dipole, and during an excursion the non-dipole parts of the field matter more, so the local field could differ. It would not differ by the factor needed.

6 · STRENGTHS AND LIMITATIONS

A rare whole-body human exposure, with no sham, six people and almost no statistics

Our assessment of the design, with the authors' own hedges and declarations given their due.

OUR ANALYSIS

Strengths

- **Humans, whole body.** One of the few studies to lower the field around a whole person rather than cells or animals, as the authors note [1 p. 6].
- **The field was measured and reported,** 143 ± 32 nT with a named three-component sensor, in a system described in an earlier paper [1 p. 4][7].
- **Two sessions a year apart pointed the same way** on every index except the myogenic share of spectral power, which fell in the first session and rose in the second [1 Table 1][1 Figs. 3–4][1 Fig. 4F].
- **Ethics, funding and interests declared:** an institutional ethics protocol of July 2023, an institute research programme as funder, and no competing interests [1 pp. 8–9].
- **Hedged language** throughout the Discussion and Conclusion: "probably", "may", "likely", "can", "suggest" [1 pp. 2, 7–8].
- **A peer-reviewed companion paper** on the same six people under the isolation alone [6].

Limitations

- **Six people, no sham, no blinding.** Earlier work with this same unit ran sham or placebo sessions, the authors' own 24-hour study [19] and an earlier human study in the same facility [20]; this one compares the end of each four-hour exposure with a background recording, so anything that happens over four hours in the box travels with the field [1 pp. 4–5].
- **Three asterisks and nothing else.** No p-values, no test for the heart-rate-variability or skin results, no correction across eleven or more indices [1 p. 5][1 Table 1][1 Figs. 3–4].
- **Four hours, twice.** No duration or dose arm, and the second session is confounded with the year of isolation [1 p. 4].
- **One skin site,** the forehead [1 p. 5].
- **Only one limitation is named.** The paper says the study "undoubtedly has a significant number of limitations", names the small number of volunteers, and lists no other [1 p. 6].
- **No data, no code.** The data statement reads "No datasets were generated or analysed during the current study", under a paper built on a table and two data figures; the code is withheld "for proprietary reasons" [1 p. 9].
- **Internal contradictions.** The Discussion reasons from a rise in venular amplitude that the results report as a fall, and reads the neurogenic rise as "a decrease in neurogenic sympathetic tone" while the scheme files it under sympathetic activation [1 p. 7][1 Fig. 5]; Figure 4F's percentages do not add up [1 Fig. 4F].
- **Editing slips.** Figure 4 has panels A–D and F but no E, and one axis reads "Isolarion" [1 Fig. 4]; reference 18 is dated 2020 but its DOI is a paper of 2022 [1 p. 11][14]; the companion paper is cited with its preprint DOI and as volume 39, where the journal version is volume 38 [1 p. 11][6].
- **Not peer reviewed.** Posted on October 7, 2026 while under review at a Springer journal, submitted on September 10; the article page shows two reviewers agreed by October 5 [1].

Where our assessment could be wrong

Figure values are our readings

Every number from Figures 3 and 4 is read off the plotted medians by eye. The paper gives no values for them and no data, so none could be recomputed [1 Figs. 3–4][1 p. 9].

The Russian review is unread

We could not obtain the 2022 review behind the reactive-oxygen sentence [9]. It may report more than the rat experiments we traced to three of its authors [11][12].

Which baseline is which

If the "Before" and "Isolation" columns are the 10 minutes before the unit was switched on, the comparison is within one session; if they are separate background days, it is not [1 pp. 4–5].

Abstracts for most related papers

We read the preprint in full; for the group's earlier studies and the ROS literature we read abstracts or records only.

Our starting point

We came to this paper while checking a claim about a magnetic pole shift, which could prime us toward skepticism. To limit that, we rated the paper's claims against its own statistics and the episode's against the paper.

What would settle it

01

A sham session in the same box with the coils off or restoring Earth's field, with the volunteers and the analysts blinded, as earlier studies in the same facility did [20][19].

02

A reported test for every index, a correction for the number of indices, and the raw data.

03

If oxidative stress is the hypothesis, a measurement of it in the blood.

04

Longer or repeated exposures with a duration arm, before anyone speaks of effects compounding over time.

A controlled replication that again found a faster heart rate in the field would firm up the paper's one significant finding; one that found the same rise in a sham session would attribute it to the box, not the field.

7 · CONCLUSIONS

A small preliminary study of blood-flow control, and no finding about reactive oxygen

The authors conclude

That under hypomagnetic conditions there is "probably" a change in how the cardiovascular system is regulated, with the sympathoadrenal system activated and the neurogenic control of microvessel tone dominant, and that such conditions "can enhance the effects of oxidative stress", a potential risk for long-duration spaceflight [1 p. 8][1 p. 2].

OUR ANALYSIS

Our conclusion

The preprint shows that six volunteers' hearts beat faster, and in one session their systolic pressure rose, after four hours in a coil system at 143 nT, with no sham session to show whether the field or the four hours in the box did it [1 Table 1][1 pp. 4–5]. Everything else in it is a direction without a test or a suggestion drawn from other papers. It measured nothing about reactive oxygen, the brain, mitochondria or blood chemistry, and it says nothing about Earth's field changing. Treat it as a preliminary observation awaiting a controlled replication, not as evidence that a weakening field is damaging the blood.

Prepared by Fact-Checked Science from the open-access text and figures of Popova et al. (2026), Research Square preprint rs-10996601/v1, CC BY 4.0, not peer reviewed [1]. The charts are redrawn from the paper's reported numbers; values from its figures are our readings. The assessment is our own and has not been reviewed by the authors.

Sources

Bracketed numbers refer to this list. For the preprint [1], p. and pp. give the page numbers printed in its footer ("Page n/15"; the PDF is paginated the same way), Fig. one of its five figures or a panel of one, and Table 1 its only table. For the episode, the time is a position in the video. For the other sources, § gives a section, p. a page and Abstract the abstract. Links checked October 21, 2026.

1 Popova, O., Rusanov, V., Pashkova, D., Popova, J., and Orlov, O. (2026). Hypomagnetic Exposure and Hemodynamic Response: Macro-To Microscale. Research Square preprint rs-10996601, version 1, posted October 7, 2026, under review at *Microgravity Science and Technology*; not peer reviewed. Open access, CC BY 4.0.

2 SpaceWeatherNews (S0) (October 20, 2026). Magnetic Pole Shift Brain Impact, Volcano Warning | S0 News Oct.20.2026. YouTube video. Quoted from the automatically generated transcript; times are positions in the video. The label "Hypomagnetic ROS" is the episode's own, on its link to the paper in the video's description.

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METHOD

How this was checked

On October 21, 2026, we checked every statement, number, quotation and citation on this page against its source: the preprint's full text and its five figures, read from the publisher's images and enlarged to check for significance marks; its Crossref record and article page, for the licence and the editorial history; and 18 other sources, 13 resolved through Crossref or PubMed and 5 taken over from our pages on the fruit-fly study and on excursions, about 90 items in all. The episode is quoted from its automatically generated transcript [2]. A fresh reviewer then read the built page against the sources. That check corrected the note on the preprint's pagination (its PDF has 15 pages, matching the printed footers), a strengths bullet that said every index moved the same way in both sessions when the myogenic share of spectral power did not, "four data figures" to two, the attribution of an earlier sham-controlled study to the authors' own group, the statement that the paper names no limitation (it names the small sample), which of the episode's words appear nowhere in the paper and which only in cited titles, the one-line reason under the False verdict, the episode's timestamps, the wording of the Context verdict and why it differs from Misread, and a dozen smaller points; the change log lists them.

The verdicts and the items tagged "Our analysis" are our own assessment, built on the cited sources: the ratios between the unit's field and Earth's, the scaling of an excursion low to the chamber, the exact Wilcoxon p-values for six pairs, our readings of Figures 3 and 4, the tracing of the paper's reactive-oxygen citation to rat red-cell experiments, and our reading of how the paper's statistics bear on each claim.

No data or code are public, so nothing could be re-run [1 p. 9]. We recomputed the median differences in Table 1 and the exact null distribution of the Wilcoxon signed-rank test for six pairs; both reproduce. Values from Figures 3 and 4 are approximate readings of the plotted medians. The Russian-language review the paper cites for its reactive-oxygen statement could not be obtained [9].

This page was researched and written with Claude, an AI assistant made by Anthropic, and then re-checked against its sources in a separate verification pass.

The verdicts on this page

FALSE	The evidence contradicts the claim.
OVERSTATED	Has some basis but claims much more than the evidence supports.
MISREAD	Cites a real source but gets wrong what it says.
UNSUPPORTED	No evidence we could find backs it up, though it hasn't been strictly disproven.
UNCONFIRMED	Rests on a preliminary result that hasn't been confirmed.
PARTLY TRUE	Part of the claim holds up and part doesn't.
TRUE	The evidence supports the claim.
CONTEXT	A question or aside rather than a claim. We add the facts it leaves out.

All ten verdicts, and how we check

CORRECTIONS

Corrections and changes

If we get something wrong, we fix it and record the change below with the date. If a correction changes a verdict, the log says what the old verdict was.

Change log

Oct 21, 2026 Published on factchecked.science after a full check against the sources. Built from the preprint posted on October 7, 2026, its five figures and 19 related sources, and from the episode's transcript; the page keeps what the preprint measured, what its authors suggest and what the episode said apart. Verdicts are on the site's scale. The timeline and the field ladder are redrawn from the preprint's Figure 2 and its reported field; the values from its Figures 3 and 4 are our readings and say so. After a fresh reviewer read the built page: the sources note no longer says the PDF has 8 sheets (it has 15 pages, matching its printed footers); the strengths list now excepts the myogenic share of spectral power, which fell in the first session and rose in the second; the paper is built on a table and two data figures, not four; the sham precedents are the authors' own 24-hour study and an earlier study in the same facility by other authors, not "the group's own" studies; the paper names one limitation, the small sample; "brain", "cognition" and "locus coeruleus" appear nowhere in the paper, and "mitochondrial" and "hippocampal neurogenesis" only in cited titles; the reason under the False verdict now says a Laschamp-sized low would be seven times stronger rather than "within an order of magnitude"; the Context definition is the site's own, with the Misread/Context distinction between the two "all …" statements made explicit; three, not two, of the Russian review's authors ran the rat experiments; the episode's timestamps are 2:19, 2:28, 2:41 and 2:47 where they were 2:13 or 2:45; the "Hypomagnetic ROS" label is credited to the episode's description; the individual points appear only on the amplitude panels; the Figure 4F shares sum to 86%, not 85%, for the first session; the myogenic band P_m is explained; the pilot's "quite pronounced" response was in one of its two groups; pNN50 counts beat intervals; the stem-cell detail is cited to both mouse papers; "suggest" is cited to the abstract; the stat tiles say the reading is from the last 10 minutes of the exposure; the Russian review's title is marked as translated; and "only statistics" became "only reported significance tests".

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