WHAT IS A CORONAL HOLE?
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Different definitions naturally arise depending on what kinds of observations are favored.

This is not what this session is about.

Instead, let’s ask,
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Instead, let’s ask, why is the Sun obliged, from the laws of physics, to form coronal holes at all?
Figure 9. Butterfly diagram of net photospheric magnetic flux. Each column is one solar rotation and the magnetic flux was summed in longitude for each sine-latitude bin. The brackets indicate timing and duration of the initial phase of development of the polar holes. White represents positive polarity and black negative polarity. North is at the top.
MORE CLUES?

LIFETIMES 8 YR
AREA 15% OR LESS

UNIPOLAR
MAGNETIC FLUX

ROTATION ~33 DY
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*Figure 6.* The absolute values of the net flux in both polar holes summed and divided by the total magnetic flux on the Sun (heavy curve) compared to the total magnetic flux on the Sun (light curve).
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POLAR CH’S ARE SIGNIFICANT IN THE SUN’S SURFACE FLUX BUDGET

*Figure 6. The absolute values of the net flux in both polar holes summed and divided by the total magnetic flux on the Sun (heavy curve) compared to the total magnetic flux on the Sun (light curve).*
SO, WHAT IS THE **PHYSICAL ORIGIN(S)** OF CORONAL HOLES?
THERE IS NO CONSENSUS.
So, what is the physical origin(s) of coronal holes? There is no consensus.

At stage center is the magnetic field, since thermal properties of coronal holes, whence the name, result from this field and its boundary conditions.
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THERE IS NO CONCENSUS.

AT STAGE CENTER IS THE MAGNETIC FIELD, SINCE THERMAL
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QUESTIONS

IS CORONAL HOLE MAGNETISM GENERATED AND ORGANIZED
ONLY BY HYDROMAGNETIC TRANSPORT PROCESSES AT/NEAR
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IS CORONAL HOLE MAGNETISM GENERATED AND ORGANIZED ONLY BY HYDROMAGNETIC TRANSPORT PROCESSES AT/NEAR THE SOLAR SURFACE, THAT WE CAN DIRECTLY OBSERVE?

THIS SEEMS TOO GOOD TO BE TRUE... SO, ARE THERE DEEP-SEATED ELECTRICAL CURRENTS IN THE SUN THAT CONTRIBUTE TO CORONAL HOLE MAGNETISM?
PROPOSITION FOR DEBATE

“THIS MEETING BELIEVES THAT CORONAL HOLE MAGNETISM IS CONTROLLED MOSTLY BY CURRENT SYSTEMS INTERIOR TO THE SUN”
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PRO: GORDON PETRIE. CON: VIC PIZZO
PROPOSITION FOR DEBATE

“THIS MEETING BELIEVES THAT CORONAL HOLE MAGNETISM IS CONTROLLED MOSTLY BY CURRENT SYSTEMS INTERIOR TO THE SUN”

**PRO:** GORDON PETRIE. **CON:** VIC PIZZO

IMPLICATIONS:

**DYNAMO (INTERIOR VS FLUX TRANSPORT)**

**SURFACE MHD PROCESSES (MAGNETIC FIELDS ON SMALL AND LARGE SCALES)**
\[ \text{curl } \mathbf{H} = \mathbf{j} + \frac{\partial \mathbf{D}}{\partial t} \]
\[ \text{curl } \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \]

\[ j' \approx \sigma \mathbf{E}' \approx \sigma (\mathbf{E} + \mathbf{u} \times \mathbf{B}) \]
\[ j' \approx j, \]

\[ \frac{\partial \mathbf{B}}{\partial t} = \text{curl } (\mathbf{u} \times \mathbf{B}) + \eta \nabla^2 \mathbf{B}, \quad \eta = \frac{1}{\mu_0 \sigma} \]