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The formation of Magnetically Active Regions on the Sun

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Magnetic active regions on the Sun's surface are the primary sources of significant solar activity. Understanding the physics behind the emergence of these active regions is essential for improving space weather forecasts, and understanding the underlying solar dynamo. Recent observational findings indicate that convection plays a crucial role in the emergence of active regions, challenging traditional models. To explore the relationship between convective flows and the formation of active regions, we aimed to identify where these regions emerge within the supergranulation flow pattern. We found that although active regions can emerge anywhere in the supergranulation pattern, they all have a net converging flow with speeds ranging from 10 to 20 m/s, occurring ~ 1 day prior to the active region emergence. This is followed by an increase in outflows leading up to the active region emergence.

Author: SCHUNKER, Hannah (University of Newcastle)

Presenter: SCHUNKER, Hannah (University of Newcastle)

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