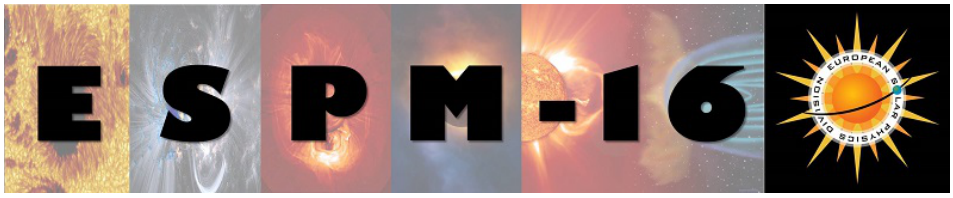

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The rotation rate of active and ephemeral regions

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The rotation rates of solar active and ephemeral regions depend on morphology and size of magnetic structures, although the reasons of the dependence are still being discussed. The aim of the work is to analyze the rotation rates of different types of magnetic tracers using magnetic field data rather than white-light images.

Magnetic field maps provided by the Helioseismic and Magnetic Imager on board the Solar Dynamics Observatory were used to measure the rotation rates of 864 active and 322 ephemeral regions observed between 2010 and 2016. We found smaller magnetic tracers to show a tendency to rotate faster as compared to larger ones. Thus, ephemeral regions exhibit on average the fastest rotation rate. We further divided active regions into three classes. Class A comprised magnetic bipoles obeying Hale's polarity law and Joy's law. The second class B included active regions violating at least one of these laws. The third class U comprised unipolar active regions.

We found no significant difference between the rotation rates of active regions of classes A and B. In contrast, unipolar active regions exhibited lower rotation rate and narrower distribution of the rotation rate differences. Assuming the rotation rate to indicate the anchoring depth of the magnetic structure within the convection zone, we supposed that active regions of classes A and B might be anchored throughout the entire convective envelope while unipolar active regions are rooted within a thin layer located either near the base of the convection zone or at a shallow near-surface depth.

Student poster?

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