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Post Alpbach-summerschool project: CARRINGTON MISSION FOR CME DETECTION TO IMPROVE SPACE WEATHER FORECAST

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The effects of solar activity, especially Coronal Mass Ejections (CMEs), on Earth- and satellite-based systems are well-known and can cause major damage to space-dependent infrastructure. The main problem in current space weather forecasting is the inability to determine necessary forecast parameters of CMEs and Corotating Interaction Regions (CIRs) early enough to react.
We present the design for a novel space mission consisting of two spacecraft that is aimed to perform stereoscopic measurements on Earth-directed CMEs and in-situ measurements of CIRs. The magnetic field orientation and structure of CMEs will be measured close to the Sun, using spectro-polarimetry. Geoeffectiveness will be derived by remote sensing the CMEs magnetic field at 0.64AU from the Sun, determining the full magnetic field vector of a CME. This will be achieved by the novel concept of measuring its polarising effects on spacecraft to spacecraft laser beams based upon heterodyne interferometry. Overall structure and trajectory of CMEs will also be monitored by heliospheric imagers and in-situ plasma instruments. To achieve the mission objectives, the orbit is heliocentric at 1AU with a separation angle from the Earth of $\pm 50^{\circ}$. The operational mission lifetime is 6 years with a proposed 6 year extension. If implemented, Carrington will serve as a forecast system which will significantly improve the minimum forecast time for the fastest CMEs with 2000 km/s, from 13 minutes based on current L1 satellites, to around 3 hours.