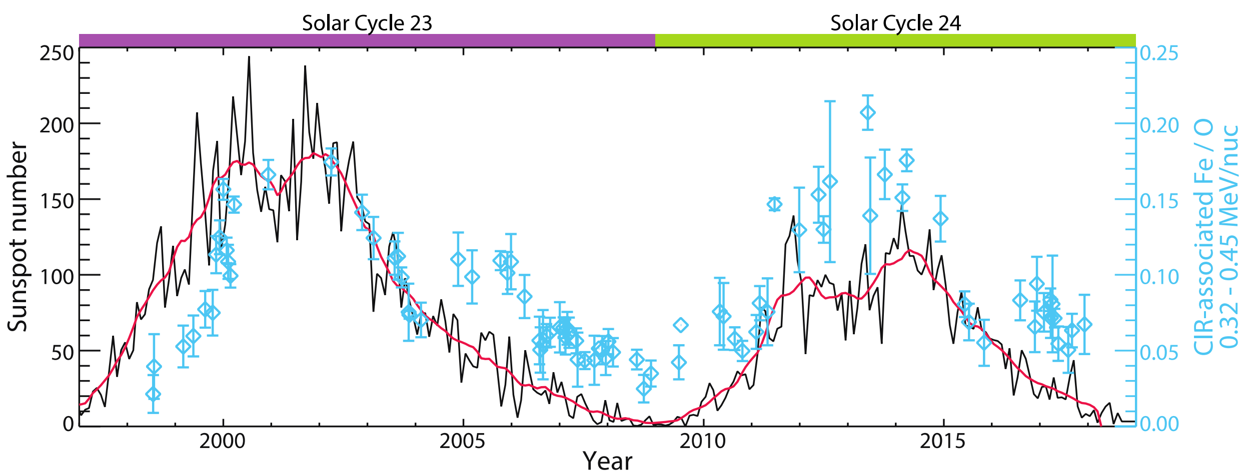
ACE News 204 – October 2, 2019
Suprathermal Ion Abundance Variations in Corotating Interaction Regions over Two Solar Cycles



Event-averaged CIR-associated 0.32–0.45 MeV/nucleon Fe/O (blue) smoothed over three events, along with the mean monthly sunspot number and smoothed sunspot number (black and red lines, respectively). The purple and green bars (top) denote the intervals for solar cycles 23 and 24, respectively.

As a faster solar wind stream overtakes preceding slower streams, a density "pile-up" of compressed plasma occurs, which can eventually form into a corotating interaction region (CIR) (Belcher & Davis 1971; Pizzo 1978; Richardson, 2018). CIRs have been found to be a major source of energetic particles in the interplanetary medium (e.g., van Hollebeke 1981, Tsurutani et al. 1982, Richardson 2018) and are known to be able to trigger geomagnetic storms (e.g., Tsurutani & Gonzalez 1997, Richardson et al. 2006, Turner et al. 2006, Richardson 2018) and can affect the ionosphere/thermosphere at Earth (e.g., Chen et al. 2014), making them important space weather phenomena.

Using 20 years (1998-2018) of ACE ULEIS data, the CIR-associated suprathermal ion composition has been compared for both solar cycle 23 and 24. The CIR-associated compositional variations observed during solar cycle 24 were nearly identical to those in solar cycle 23. CIR-associated 0.32-0.45 MeV/nuc Fe/O previously observed for solar cycle 23 (Mason et al. 2012) were seen to be largely repeated in solar cycle 24. A small enhancement in CIR-associated Fe/O during the declining phase was seen for both solar cycle 23 and 24, suggesting the seed populations may be different between the declining and ascending phase. The CIR-associated Fe/O ratio is found to be correlated with both the event-averaged Fe and O intensities, which are found to have a slight solar-cycle dependence. As such, the processes leading to enhanced Fe intensities during solar maximum may be preferentially accelerating Fe rather than O. The ratios of relative ion abundances during CIRs are found to be virtually the same for both solar cycle 23 and 24. For both solar cycles, the abundances in CIR-associated suprthermal ion composition were found to be close to that in the fast speed solar wind, with the exception of He and Ne. The fact that the CIR-associated energetic ion composition for both solar cycle 23 and 24 share so much in common can point to what is likely to be observed in solar cycle 25.

For further details, including references, see Allen et al. ApJL, 883, 1, L10, 2019.

This item was contributed by Robert Allen (JHUAPL). Address comments and questions to Robert.Allen@jhuapl.edu. See ACE News Archives for earlier ACE News items.