$^3$He rich periods measured by the Suprathermal Ion Telescope (SIT) on STEREO-A during solar cycle 24

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$^3$He-rich solar energetic particle (SEP) events are characterized by a peculiar elemental composition with rare species like $^3$He or ultra-heavy ions tremendously enhanced over the solar system abundances. We report on $^3$He rich SEP periods measured by the Suprathermal Ion Telescope (SIT) onboard STEREO-A beginning in 2007 until 2020, covering the whole solar cycle 24.

The mass resolution capabilities of SIT do not allow to easily distinguish between $^3$He and $^4$He especially in cases of a low $^3$He to $^4$He ratio. We therefore developed a semi-automatic detection algorithm to find time periods during which a $^3$He enhancement can be statistically determined.

Using this method we found 112 $^3$He rich periods. These periods were further examined in regards of their $^3$He/$^4$He and Fe/O ratio. Previously about ten $^3$He-rich SEP periods measured by SIT on STEREO-A have been reported. An association with in-situ electron measurements by STEREO-SEPT and STEREO-STE showed that about 60% of the 112 periods are accompanied with electron events.

The here presented catalogue of $^3$He rich periods is intended to serve as a reference for the community.