NICER Sees Hot Spots Merge on Magnetar

For the first time, the NICER mission observed the merging of multimillion-degree X-ray spots on the surface of a magnetar, a supermagnetized stellar core. These objects pack twice the mass of the sun into a ball about 20 km across and have magnetic fields thousands of time stronger than typical neutron stars.

In October 2020, the magnetar SGR 1830 had a dramatic outburst, observed by Goddard's Neil Gehrels Swift mission. NICER measurements from the same day show that the X-ray emission exhibited three close peaks with every rotation. They were caused when three individual surface regions much hotter than their surroundings spun into and out of our view.

Over the next month, the emission peaks gradually shifted, occurring at slightly different times in the rotation. The team thinks there is a single active region where the crust has become partially molten, slowly deforming under magnetic stress. The three moving hot spots likely represent locations where coronal loops – similar to the bright, glowing arcs of plasma seen on the Sun – connect to the surface.

The NICER mission has revolutionized our view of these dramatic objects and contributed to our understanding of the underlying physics of matter in its most extreme form.

Artist's conception of the three hot spots that merged

nasa.gov/feature/goddard/2022/nasa-s-nicer-telescope-sees-hot-spots-merge-on-a-magnetar