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A study of the infrared emission of SGR/AXPs in a disk scenario and its implications for their origin

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Soft Gamma-Ray Repeaters and Anomalous X-ray Pulsars (SGR/AXPs) are isolated compact stars identified due to a characteristic quiescent soft X-ray emission as well as bursts events. They can also emit in other energy ranges, from radio up to hard X-rays. Their nature is still a question for debate, and several emission mechanisms have been proposed, such as neutron star (NS) with a super-strong decaying magnetic field (magnetar model), accreting NSs, white dwarf (WD) pulsars, and accreting WDs. Among its broad energy range, the infrared (IR) emission, exhibited by about 50 % of the class, is perhaps the least studied energy range. For 4U 0142+61, this IR is well modeled by an irradiated disk, reinforced by an unconfirmed silicate feature around 9.5μm. Nonetheless, some authors still argues in favor of an IR magnetospheric emission for the class. Unfortunately, the classical approaches to distinguish between those two models (search for polarization and pulsed fractions) can be inconclusive. For this reason, we propose a different method: the search for a correlation between the luminosities in IR and X-rays that can be confronted with the expected correlation for a disk and magnetospheric models. Our results point out a correlation consistent with an irradiated disk.

This disk surrounding SGR\AXPs can open a different path to test SGR/AXPs origin. For instance, if the leftover of a supernova event formed the disk, it probably contains iron, silicon, oxygen, helium, and traces of hydrogen. On the other hand, if SGR\AXPs were WDs formed after a merger, the disk would contain mainly carbon and oxygen, with traces of other elements such as neon, magnesium, and silicon. In this sense, an IR spectroscopy of 4U 0142+61, the magnetar with the brightest quiescent emission, could give essential clues to the origin of the class.

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