

How to find metal-rich asteroids — a NEOShield study

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The metal content of asteroids is of great interest, not only for theories of their origins and the evolution of the Solar System but, in the case of near-Earth objects (NEOs), also for impact mitigation planning and endeavors in the field of planetary resources. However, since the reflection spectra of metallic asteroids are largely featureless, it is difficult to identify them and relatively few are known. Furthermore, due to their robustness and ability to survive passage through the atmosphere, metallic objects are disproportionately well represented in meteorite collections on the Earth. Understanding the true number of metal-rich objects in the Solar System remains as a longstanding problem.

With reference to radar albedos and taxonomic classifications, we show that data from the Wide-field Infrared Survey Explorer (WISE)/NEOWISE thermal-infrared survey and similar surveys, fitted with a simple thermal model, can reveal asteroids likely to be metal rich. Objects revealed in this way should become priority targets for further optical, thermal-infrared and radar observations, and thermophysical modeling, in order to improve our knowledge of the factors governing NEO thermal and spectral properties, especially metal content.

An important implication of our work is that there are many more metal-rich asteroids waiting to be identified. Future infrared surveys, equipped with sensors operating at multiple thermally-dominated infrared wavelengths, could therefore provide valuable information not only for assessment of the impact hazard, but also on the potential of NEOs as reservoirs of valuable materials for future interplanetary space activities and, eventually perhaps, for use on the Earth.

A first paper describing this work has recently been published: Harris, A. W. & Drube, L., 2014, *Astrophys. J.*, 785, L4.

Acknowledgements: The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 282703 (NEOShield Project).