Astronomy in Focus - XXX
Proceedings IAU Symposium No. XXX, 2018
M. T. Lago, ed.

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doi:10.1017/S1743921319003284

Recent results in family identification

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Abstract. To select asteroid families, the D(a) distribution of asteroid sizes by their semimajor axes and the N(p) distribution of the number of asteroids by their albedo values for individual families were used. A statistically significant reduction in the mean albedo with increasing semimajor axis is observed for almost all correctly identified families that are not truncated by resonances. This points on an action of a specific nongravitational effect (NGE) in the asteroid belt, and results in the spatial separation of asteroids with different albedos.

1. Introduction

Usually the H(a) absolute magnitude distribution by proper semimajor axes are used to select families. The D(a) distribution gives clearer picture on the correctness of the family selection, since the D values are obtained with taking into account the albedo of separate bodies. The D(a) distribution for a family should have a central maximum with descending wings on either side. Each parent body belongs to a certain taxonomic type. Therefore, the albedos of all members of the family should not greatly differ from the albedo typical for this type. Thus the N(p) distribution for a family should have a single primary maximum with a certain scatter on either side. This distribution should not have a pair (or more) of such maxima.

2. The albedo distributions for separate families

The p(a) distribution of a family asteroid albedos by their semimajor axes right after the parent body disintegration should be close to a uniform one. Gravitational disturbances in the process of evolution of orbits cant affect this distribution qualitatively as well. So the p(a) distributions for separate families at present can show an influence of a NGE on the families. Of course, the families should be correctly identified and not truncated by resonances. There were selected 21 such families using the D(a) and N(p) distributions. The D and p values were taken from the WISE database (Masiero *et al.* 2011). The averaged linear p(a) dependences were plotted for these 21 families: p = b1 a + b0. A possible NGE influence exerted on the asteroids from a certain family is detected by the value and significance of b1 coefficient. If this coefficient differs from zero at a sufficiently high statistical significance, one may conclude that a NGE influence on the bodies of a family is actually manifested. The b1 coefficients are negative for 15 of 21 families. The b1 values are significant at a level of 2-sigma and higher for 8 of 15. There are no significant positive b1 values. The b1 value for 221 Eos family is significant at a level higher than 13-sigma. The accuracy of proper semimajor axes and albedos are similar for all families. Thus we may superpose the centers of all families and compare the average albedos of the left wing and the right one for that of the combined family. We renormalize the center of each family to be equal to 3.00 AU,

https://doi.org/10.1017/S1743921319003284 Published online by Cambridge University Press

while keeping unchanged the difference of proper semimajor axes of every family from the center. The combined family includes more than 7500 bodies of 20 families (without the 221 family). The b1 coefficient in the p(a) dependence for the family is equal −0.11 at a significance of higher than 18 sigma. Thus one may be sure that the average albedo decreases along the proper semimajor axes inside the asteroid families.

3. Conclusions

Using the asteroid sizes and albedos gives a possibility to identify the families more correctly. The average albedo decreases along the proper semimajor axes inside the asteroid families. This points on an action of a specific NGE in the asteroid belt results in the spatial separation of asteroids with different albedos.

References

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