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Absrtact: We present a study of 107 Cybele asteroids based on the archival data base "Asteroid Catalog Using AKARI(AcuA)" taken by the infrared astrnomical satellite [1]. The data base provides diameters D > 10 km, geometric albedos and taxonomic informations (75%) of the Cybeles. We find taxonomic diversity (mainly C-, D- and P-type) in the population of seventy-eight small Cybeles with diameters 10 km < D < 80 km. Their cumulative power-law size distribution index shows a shallow value of 0.86 ± 0.03. By contrast, twenty- nine large Cybeles with D > 80 km are mostly classified as C- or P- types (90%), having a power-law index of 2.39 ± 0.18. The total mass of Cybele asteroids is estimated to be ~ 10^{-5} $M_{(Earth)}$. We discuss the origin and formation process of Cybele asteroid family.

This work is to be published in *The Astronomical Journal* [2].

Overview: The Cybele asteroids populate in the outer main belt. The semimajor axis, inclination and eccentricity are $3.27 < a \leq 3.70$ AU (between the 2:1 and 5:3 resonances with Jupiter), $i \leq 25°$ and $e \leq 0.3$, respectively [3]. The Cybeles and the other outer main belt asteroid groups, Hilda and Jovian Trojans, used to be commony accepted as a primordial origin [4]. Or, as the Nice model taught, they might have been scatted objects from the trans-Neptunian region [5]. TNOs-like pristine and icy natures are expected to be found from outer main belt objects. Those three groups are actually classified as C-, D- and P -type asteroids in the Tholen taxonomy system with low geometric albedos [4].

The Cybeles locate at the unique transition zone between inner and outer solar system. C-type asteroids in the Cybele region occupy relatively larger fraction (28%) than those of the Hildas (16%) and Trojans (≤10%) [6, 7, 8]. Nearby, at a ~ 3.2 AU, main belt comets (hereafter MBCs) reside as active icy C-type asteroids. Some of them could be products of shattering collisions from the Themis and Beagle families, which perhaps involve icy parent bodies in the outer main belt. Those precursor objects are expected to possess ice-rich interiors [9 and referecens therein].

The shattered formation of the Cybele group is unknown. Impacts by small scale projectiles (D~20m) on the 100 km-scale asteroids (24) Themis and (65) Cybele are frequent, which perhaps excavates buried ices onto their surfaces [11]. Indeed, possible surface water ices have been reported [e.g. 10]. On the other hand, asteroid families are generally formed by massive collisional activities between 10~100 km-scale objects. The Cybele family is speculated to have experienced shattered events in the past just because numerous small D-type asteroids are found in common with the potential collisional families: the Hildas and Trojans [12]. The latter two have been distinctively studied by observations and their physical parameters of sizes, geometric albedos and taxonomy have been measured statistically, as well as dynamical models. As for the Cybele family, their taxonomic features have been revealed with a large number of samples, whereas there are a few thermal infrared studies on the representative object (65) Cybele [13]. To discuss the collisional history more, infrared informations of the population are necessary.

In this talk, we present infrared observational results (diameters and geometric albedos) and taxonomic characters of the Cybeles. We study their orbital properties, size distribution and diameter/albedo-taxonomy relations. Based on these results, we do approach the origin and formation of the Cybele asteroid group.

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