

IRAS ASTEROID AND COMET GROUND-BASED DATA FILE; David F. Bender and Edward F. Tedesco; Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, U.S.A.

One of the major requirements for reducing asteroid and comet data obtained by the Infrared Astronomical Satellite (IRAS) was the availability of a master file of ground-based data. This file would need to include orbital elements for identifying objects and absolute magnitudes, UBV colors, taxonomic classifications, and results from thermal infrared studies to aid in reducing IRAS fluxes to albedos and diameters. DFB has collected and provided the orbital data and EFT has collected and provided the other data and has integrated all the data into the master file, which is being described by this paper. Descriptions of the data sets included and details on their creation are given below.

The most important ground-based data set is that of the orbital elements since it is from these data that the known objects are identified and their distances and phase angles at the time of observation determined. The heliocentric distance, geocentric (actually asteroid-spacecraft) distance, and phase angle are used in reducing IRAS flux measurements. The known orbital elements include data on numbered asteroids (supplied by B. Marsden), unnumbered asteroids with reliable orbital elements (supplied by E. Bowell), and comets (supplied by B. Marsden and D. Yeomans). There are 3318 numbered asteroids in the file and this includes those numbered through Sept. 1985(MPC 10046). Recent numbering of asteroids reduced the unnumbered group to 135 objects. All periodic comets near the Earth and Sun from 1982 to 1985 were included as well as all other comets observed during those three years, making a total of 109 comets.

The IRAS spacecraft was in operation from January 25, 1983 until November 28, 1983, a total of 278 days. In order to have as accurate predictions as possible, it was decided to provide osculating orbital elements at two epochs which would divide the flight time up so that no prediction would have more than an 80-day difference from epoch to its date. The dates chosen were JDE 2445440.5 and 2445600.5 or April 16, 1983 and Sept. 23, 1983.

For the numbered asteroids, the data file provided to us by B. Marsden contained asteroid orbital elements integrated to the standard 1985 epoch of Dec. 1, 1985 or JDE 2445600.5. The orbital elements in this file and those supplied to IRAS are: perihelion distance, eccentricity, inclination, longitude of the ascending node, argument of perihelion, and date of perihelion. Note that comets with parabolic or hyperbolic orbits can be accommodated in this file.

The trajectory of each object was integrated with planetary perturbations from its given epoch to the two desired epochs in 1983, using a fifteenth order Cowell integration program written by E. Everhart of the University of Denver(1). The program is written in FORTRAN 77 and was used on a micro-computer (e.g., IBM-PC). An

approximate ephemeris for all planets from Mercury through Neptune that can be used on micro-computers was generated for us from the JPL ephemeris DE118 by X. X. Newell. It consists of a file of planetary positions at two-day intervals and a cubic interpolation scheme.

The second most important ground-based data set is that of the absolute magnitudes. These data are required to compute the asteroid's visual flux, which is needed to determine the diameter and albedo from the IRAS infrared fluxes. Due to the recently agreed upon asteroid magnitude system (2) and the large number of photoelectric magnitude observations obtained since the last magnitude data set was prepared (3), a new absolute magnitude listing was created. This magnitude system was adopted by IAU Commission 20 at the November 1985 General Assembly.

The B-V color index is needed to convert the B magnitude given in the absolute magnitude database into a V magnitude for use in the thermal modeling algorithm used to compute the model albedo and diameter. The UVB color file was created using TRIAD UVB and Eight-Color Asteroid System data (4,5).

The Thermal Radiometry (albedos and diameters) and Taxonomic Classification data sets are not needed directly in order to reduce IRAS flux data to albedos and diameters. They are needed, however, in assessing the quality of the IRAS-derived data for the numbered asteroids and, by extrapolation, for the unknown asteroids as well. These data were also needed to create the absolute magnitude database.

The Thermal Radiometry database was created using the TRIAD file (6), updated, using recently published (7) and soon-to-be published (8) radiometry data sets. The Taxonomic Classification database is essentially that given by Tholen (9) augmented by subsequent ground-based albedos, which were used to resolve albedo-dependent ambiguities, primarily among the E, M and P classes, and among the sub-classes of the C asteroids.

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