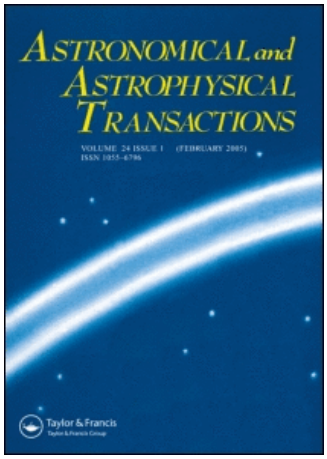


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# Space ecology and observational astronomy

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# SPACE ECOLOGY AND OBSERVATIONAL ASTRONOMY

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KEY WORDS Space ecology.

Along with outstanding achievements, the practical exploitation of circumterrestrial space has led to negative consequences among which one should note first the deterioration of space ecology. Space pollution may have most unexpected consequences but even today its negative effect on space flight safety and observational astronomy is evident. On the other hand, the sensitivity of astronomical instruments to space pollution indicates the possibility to use them for ecological monitoring. Some data about the types, causes and characteristics of space pollution are presented below.

1. *Mechanical pollution*: This includes: The formation of debris and splinters after incidental and deliberate outbursts and collisions of spacecrafts. The presence of unused spacecrafts and fragments (fairings, boosters, covers, etc.). The total number of elements is: $8 \cdot 10^3$ over 20 cm in size, $5 \cdot 10^4$ of 1–20 cm; $1 \cdot 10^9$ less than 1 cm in size. The altitudes of 350–2000 km and stationary orbits are most occupied.

Consequences: The danger of collision and damaging of separate onboard systems, the deterioration of functions of or fatal damage to spacecrafts including those with the Hubble-type equipement. A threat to space crews.

2. *Radioactive pollution*: Emergency and standard work and crashing of onboard nuclear reactors, technological and scientific plants with nuclear and X-ray sources. The total number of the reactors approximates 100 (56 of them are on the 800 km orbits). Burying of radioactive waste in far space (a project).

Consequences: The fall-out of radioactive substances and materials on the Earth. Interference to X-ray and $\gamma$-astronomy. The danger of damaging on-board electronics.

3. *Chemical pollution*: Crashes of engines, fuel tanks and technological plants. The blowing off of fuel components and gases on orbits.

Consequences: Formation of a cloud which is dangerous for facilities, equipment and space crews. Diffusing of chemical substances into environment.

4. *Radiotechnical pollution*: Standard work of the on-board radiosystems of different types and purposes, in particular the navigation spacecraft transmitters at 1381 MHz and 1600 MHz.

Consequences: Interference of radioastronomy.

5. *Optical pollution*: The presence of artificial objects emitting and reflecting optical radiation. The creation of giant orbital solar reflectors (a project).

Consequences: Interference to ground-based optical telescopes, astronavigation and astroorientation systems.

6. *Biological pollution*: Planned or incidental orbital injection of biological objects.

Consequences are not known.

7. *Gravitational pollution*: The presence of artificial objects with the total mass of $2.4 \cdot 10^6$ kg on orbits.

Consequences are not known.