

U14300 Crookes radiometer

Instruction Sheet

5/03 ALF



The Crookes radiometer is used for demonstrating the conversion of radiation energy into kinetic energy.

1. Safety instructions

- Caution! Handle the glass vessel carefully to avoid breakage and resulting injury.

2. Description, technical data

The apparatus consists of a rotary-vane wheel mounted on a metal tip and equipped with four vertical plates connected to a shaft that is free to rotate around a vertical axis. Each vane is colored black on one side. It is housed in a more or less evacuated glass bulb.

Height: 210 mm
Ball diameter: 80 mm

3. Operation and operating principle

- Allow light from the sun, from a light bulb or the heat from an oven to incident on the radiometer.
- The vane wheel starts rotating with the bare surfaces leading.

The rotation is caused by a temperature difference between the plain surface and the blackened surface of the vaned wheel (turbine), which produces a slight difference in the gas pressure on the two surfaces.

Incoming photons are mostly absorbed by the black vanes and mostly reflected by the bright vanes. The air next to the black vanes is then hotter, and so the air molecules there have greater average kinetic energy, pushing the black vanes and causing the device to spin.

- Heat the radiometer over a radiator to just above room temperature.
- Screen it against direct radiation.
- The vane rotates for a short time in opposite direction.

Heat is transported in the opposite direction and the blackened surfaces cool off more rapidly than the bright vanes.

This second experiment proves that the rotation is not caused by the radiation pressure of the incident radiation but by the greater recoil.