Your Majesties, Your Excellencies, Mrs Crafoord, Mr President, Ladies and Gentlemen:

The Royal Swedish Academy of Sciences has decided to award the Crafoord Prize 1989 to Professor James Van Allen for his pioneering exploration of space, in particular the discovery of the energetic particles trapped in the geomagnetic field, which form the radiation belts - the Van Allen belts - around the Earth.
The Van Allen belts can be seen in Fig. 2, deep inside the magnetosphere. They consist of energetic charged particles - that is electrons and ions - with very high energies (up to several hundred MeV) i.e. the highest energies found in the magnetosphere. They move around the Earth in the geomagnetic field (as shown in Fig. 3) with continuous bouncing between mirroring points in the two opposite hemispheres and with a circular motion around the magnetic field lines as the most short-period of these three periodic components of the motion.

The discovery of the Van Allen belts in 1958 was the first great surprise of space research. The Norwegian physicist Störmer had shown theoretically many years before that charged particles can move in trapped orbits around the Earth, but as such orbits can be reached from neither outside nor from inside in a static system, no one believed that there could exist particles in such orbits, at least not in large numbers. Van Allen’s Geiger-Muller tube onboard the first US satellite, Explorer I, showed a strongly decreased counting rate at altitudes above 1000 km in a region in the South Atlantic, where the geomagnetic field is weaker than over other parts of the Earth. Van Allen interpreted the low count rate as due to the particle flux being so high that the instrument was overloaded and saturated. This interpretation was confirmed by his later investigations during early 1958.

The Van Allen belts are not only important scientifically but they also affect practical space activities around the Earth. The practical effects have primarily to do with the high radiation intensity in them. The fluxes of energetic particles are so high that manned spacecraft have to stay out of them or pass through them as fast as possible, and even for unmanned spacecraft the orbits are generally chosen so that the radiation belts are avoided as much as possible in order not to have the electronic equipment damaged. Radiation doses of $10^5$ rad ($10^3$ Gray), above which it is difficult to keep electronic equipment alive, are easily obtained in satellite orbits which spend much time within the more intense parts of the Van Allen belts. Only a few thousandths of these values, i.e. a few hundred rad or a few Gr, are deadly doses for human beings.