X-ray Spectral Analysis of Non-equilibrium Plasmas in Supernova Remnants
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Supernovae are some of the most energetic events known in the Universe. For a short time they can shine as bright as their entire Galaxy, allowing us to observe them up till very large distances. Supernovae are the result of the explosion of either a white dwarf, or a star with a mass larger than about five times the mass of our own Sun. In the explosion, the material from which this progenitor star consisted is flung out into the surrounding space, at velocities of thousands of kilometers per second. This material is heated up to millions of degrees, and keeps on glowing for thousands of years. These glowing remains of the explosion are called supernova remnants.

In this thesis we study supernova remnants by looking at the X-ray radiation emitted by the hot ionized gas, called *plasma*, of which it consists. The particle densities in these plasmas are very low: about 1 atom cm^{-3}, compared to the 10^{19} atoms cm^{-3} in the earth atmosphere. Interactions between the different particles are therefore rare and changes in one part of the plasma take a long time to be communicated to the rest of the plasma. The plasma is therefore said to be *out of equilibrium*. We studied these non-equilibrium effects to learn more about plasma physics at the extreme conditions present in supernova remnants. In addition, we used it to show that two puzzling supernova remnants, RCW 86 and Kepler, exploded in an environment heavily influenced by its progenitor system.