EXTRAGALACTIC RADIO SUPERNOVAE IN NGC 4321 AND NGC 6946

R. A. Sramek
National Radio Astronomy Observatory, Socorro, NM
K. W. Weiler
National Science Foundation, Washington, DC
J. M. van der Hulst
University of Minnesota, Minneapolis, MN

ABSTRACT

The supernovae SN1979c in NGC 4321 and SN1980k in NGC 6946 have both been detected at centimeter wavelengths at the VLA. The radio emission turns on very rapidly, but may be delayed by as much as a year with respect to the optical outburst. In both supernovae, the 20 cm radiation peaks after the 6 cm, and the radio emission has a very slow post-maximum decay.

On April 6, 1980 the bright Type II supernova SN1979c in NGC 4321 was detected at the VLA at 6 cm (Weiler, et al, 1981). There was only a single prior observation, made a year earlier, about one week after the optical maximum, which showed no detection with a 0.3 mJy upper limit. Following the successful detection, regular observations of SN1979c were made at 20 cm, 6 cm, and occasionally at 2 cm to obtain the first radio light curve of a supernova. At 20 cm, SN1979c remained undetected until a December 4, 1980 observation showed that it had risen quickly to 2.1 mJy. Meanwhile, a second bright Type II supernova, SN1980k, was seen is NGC 6946. Radio monitoring was begun, and it was detected at 6 cm, 36 days after the optical maximum. Two and one half months later it was detected at 20 cm. The radio light curves up to May 6, 1981 for the two supernovae are shown in Figure 1.

The light curves are characterized by:

a) A very fast rise time, with time to the power 4 or 5 at 20 cm.
b) A spectrum that is steeply rising at early times then flattens out. The 2 cm data indicates that the spectrum between 6 cm and 2 cm slopes down with an index of about -0.8.
c) Peak flux densities that are comparable at 6 cm and 20 cm.
d) The rise occurs first at higher frequencies, and is delayed relative to the optical outburst.
e) The decay is much slower than the rise.
f) neither the rise nor the decay is simple monotonic; both show irregularities.

D. S. Heeschen and C. M. Wade (eds.), Extragalactic Radio Sources, 391–392.

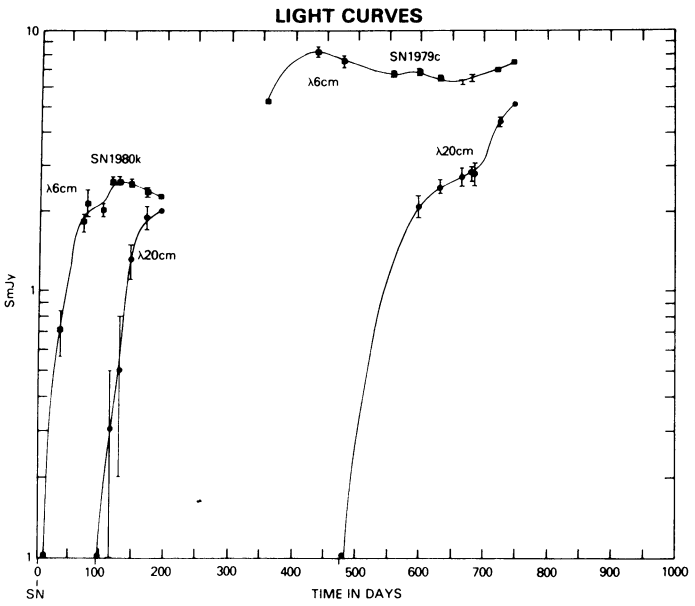

Figure 1. The radio light curves for two recent supernovae, with the times relative to their respective optical maxima.

These light curves are probably best explained by time varying absorption, either synchrotron self-absorption or free-free absorption, although the rise time in a) gives some problems for the former.

REFERENCE

Weiler, K.W., van der Hulst, J.M., Sramek, R.A., and Panagia, N. 1981, Ap. J. Lett., 243, L151.

https://doi.org/10.1017/S0074180900028278 Published online by Cambridge University Press