they interpreted this as evidence of the presence of multiple scattering (on dust), which could lower the polarization associated with the scattering process. This interpretation was introduced to save the idea (being forwarded at the time) of HH objects as dense clouds which reflected the light of (directly unobservable) young stars. Schmidt & Vrba (1975) lowered the limit of the (undetected) polarization of HH 1 and 2 to a fraction of 1%, and (correctly) concluded that the emission from HH 1 and 2 had to be intrinsic. The paper of Mundt & Witt (1983) explored the possibility that the UV continuum of HH 1 and 2 might be contaminated by a reflected, blue star continuum (a suggestion that was later put aside).

Interestingly, the problem of scattering on dust gained new life with the paper of Solf & Böhm (1991), who detected the presence of faint but very broad line profiles off the bright knots of HH 1. They interpreted this as evidence of scattering on environmental dust of the emission spectrum of the HH 1 knots. This idea was explored theoretically by Noriega-Crespo et al. (1991), Henney et al. (1994) and Riera et al. (2005).

Warren-Smith & Scarrot (1999) carried out continuum and Hα imaging polarimetry of the HH 1/2 system, finding polarizations of a few percent in the Hα emission at some positions around HH 1. No comparison has been made with the polarization predictions of Henney et al. (1994). There is clearly room for more work on this topic.

8.3. *The emission line spectrum*

The emission line spectrum (UV, optical, IR and radio) of HH 1 and 2 provides most of the information known about these objects. The best data currently available on the optical emission line ratios of HH 1 were obtained by Solf et al. (1988, who identified 175 lines). The best IR spectrophotometry was carried out by Gredel (1996) and by Molinari & Noriega-Crespo (2002, ISO spectra), and the best UV data were obtained by Böhm et al. (1993, IUE data) and by Raymond et al. (1997, HUT data).

The emission line ratios observed in HH 1 and 2 have motivated the shock interpretation of HH objects (Schwartz 1975). The spectra of HH 1/2 were first compared with predictions of plane-parallel shock models (Dopita 1978; Raymond 1979). The spectrophotometric observations of Brugel et al. (1981a) later showed that the emission of HH 1/2 (and a set of other HH objects) has low filling factors of $\sim 10^{-3} \rightarrow 10^{-2}$ (depending on the emission line), which is one of the main qualitative observational features expected for shock emission.

Later, comparisons with "3/2-D" bow shock models (built as an appropriate superposition of 1D shocks) were done by Hartmann & Raymond (1984) and Hartigan et al. (1987). The last two papers showed that the combination of (normal) shock velocities produced by a continuous bow shock resulted in line ratios that better reproduced the HH 1 and 2 spectra. Predictions of the spatially resolved line emission were later carried out by Noriega-Crespo et al. (1989, 1990).

The main success of the 3/2-D shock models was to reproduce some of the characteristics of the emission line profiles and/or PV diagrams of HH 1 and 2. Raga & Böhm (1985) presented 3/2-D bow shock models that reproduced the general characteristics of the PV diagrams of HH 1 obtained by Böhm & Solf (1985). In an earlier paper, Choe & Böhm (1985) had obtained predicted PV diagrams that actually agreed better with the HH 1 observations, but these models did not have a proper calculation of the line profiles from the bow shock.

Hartigan et al. (1987) modeled the line profiles of HH 1 and 2 (not PV diagrams), assuming that each condensation is a separate bow shock. This was an important difference from the models of Raga & Böhm (1985), in which all of HH 1 was modeled as a single bow shock. Later, higher angular resolution observations of HH 1 and 2 (e.g., Hester et al. 1998) showed that the condensations of HH 1 (some of them shaped as small, bow shaped shocks) do indeed seem to form a single, broken up bow shock, while the condensations of HH 2 do not form a discernible, organized larger scale structure.

While some effort has been done in modelling HH 1 (Raga 1988; Blondin et al. 1989; Völker et al. 1999) and HH 2 (Stone & Norman 1994) with full (axisymmetric or 3D) jet simulations, more work in this direction should clearly be made. For example, it would be important to carry out high resolution 3D simulations of both HH 1 and 2 to see whether or not predictions from the models are successful at reproducing the 2D distributions of emission line ratios and profiles (Solf et al. 1991; Böhm & Solf 1992) and proper motions (Bally et al. 2002). At the same time, these models should reproduce the spatially resolved line emission and line profiles of the HH 1 jet (Nisini et al. 2005; García López et al. 2008).

Such simulations should settle the doubts that still remain as to whether or not the line ratios, line profiles and proper motions observed in HH 1 and 2 can indeed be reproduced by a single model. Furthermore, this model should also be able to reproduce the observed X-ray emission of HH 2 (Pravdo