wind velocity as measured from both the HeII and CIV profiles turns out to be 1,550 km/s which is significantly lower than that measured from Hα. This may be due to the depletion of hard ionizing photons which restrict the presence of CIV to regions closer to the star.

Discussion

It appears that in a broad sense the properties of the mass-loss process in the hot stars of the Magellanic Clouds and those of our own galaxy are very similar, although differences of detail, as already shown by Hutchins (*Ap.J.* April 1980, **237**, 285), can be seen and will be further investigated.

Of particular interest is the confirmation of a correlation found for galactic OB stars (Panagia and Macchetto, in preparation), between the terminal velocity and the effective temperature. A similar correlation between terminal velocity and excitation class has been found by Willis (Proceedings of the Second European IUE Conference), for WN stars. In both cases the higher the effective temperature the higher is the terminal velocity. In addition, for all high-temperature (or high-excitation) stars the momentum carried by the mass-loss ($\dot{M}V_{\infty}$) exceeds the momentum that the stellar radiation can release to the wind through *single* scatterings, by factors of between five and ten.

Clearly a more efficient mechanism for the wind acceleration is required. Such a mechanism has been proposed by Panagia and myself. It consists of the multiple scattering of hard ultraviolet photons in the approximate range 200 Å to 500 Å. In a qualitative way the mechanism can be described as follows. In the wavelength range 200 Å to 500 Å there are of the order of one hundred strong atomic and ionic lines. The average separation between lines is then of the order $c\,\Delta\lambda/\lambda = 1{,}000$ km/s.

A photon emitted by the star in this wavelength range will be absorbed by some layer of the envelope at some distance from the star. After undergoing a number of local scatterings, which do not contribute any net momentum to the wind, the photon will preferentially be scattered backwards to the opposite side of the envelope where it will be reabsorbed by a line shifted toward the red by $c\,\Delta\lambda/\lambda = 2V$ relative to the transition which had produced the first absorption. The process is then repeated. In each one of these scatterings the photon will contribute net momentum to the wind. Our calculations show that the process can be repeated a number of times (between 5 and 20), before the photon eventually escapes outwards or falls back on the star where it is thermalized. Therefore the momentum imparted to the wind by this mechanism can be several (e.g. 5 to 20) times the luminosity in the wavelength range 200 Å – 500 Å divided by the speed of light. This is just what is required to produce the observed velocities in the winds of the hot stars.

It has to be stressed that this mechanism is only useful in accelerating the wind but it presupposes the existence of the mass-loss. In other words we have not yet explained how the mass-loss itself is produced.

I am convinced that in the coming years a concerted attack based on ultraviolet, visible and infrared observations will produce the evidence required by the theoreticians to solve the problem of mass-loss.

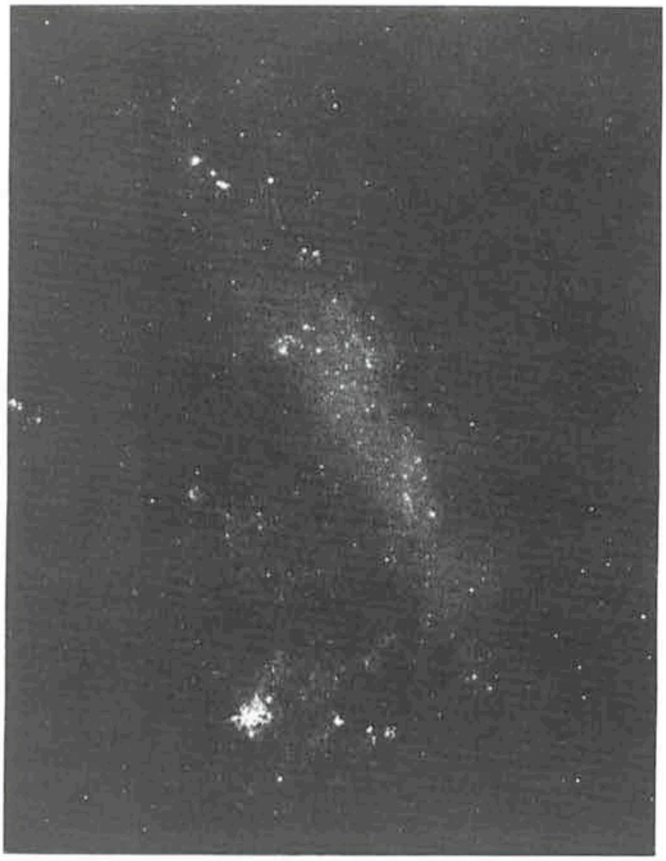

Fig. 4: *The Large Magellanic Cloud.*

PERSONNEL MOVEMENTS

STAFF

ARRIVALS

Europe

Raimund SCHULTZ, D, Driver/General Clerk, 16. 5. 1980
Gianni RAFFI, I, Software Engineer, 1. 7. 1980
Marie-Françoise BERNARD, F, Bilingual Secretary, 1. 9. 1980
Jean QUEBATTE, CH, Assistant Photographer, 1. 9. 1980
Claus MADSEN, DK, Photographer, 1. 9. 1980
Eduard STORTENBEEK, NL, Buyer, 1. 9. 1980
Charlie OUNNAS, F, Astronomical Applications Astronomer, 1. 10. 1980

Chile

Paul LE SAUX, F, Systems Analyst/Programmer, 1. 7. 1980
René NERI, F, Electromechanical Engineer, 1. 7. 1980

DEPARTURES

Walter GROEBLI, CH, Designer/Draughtsman (Mechanical), 30. 6. 1980
Bernard FOREL, F, Technical Draughtsman (Mechanical), 31. 7. 1980
Calixte STEFANINI, F, Head of Personnel, 31. 7. 1980
Gilles GOUFFIER, F, Accountant, 31. 7. 1980
Roy SAXBY, UK, Photographer, 31. 8. 1980
Alain PERRIGOUARD, F, Systems Programmer, 31. 8. 1980

Jean-Claude FAUVET, F, Electronics Engineer, 31. 8. 1980
Robert CLOP, F, Mechanical Engineer, 31. 8. 1980
Wolfgang RICHTER, D, Head of Engineering Group, 31. 8. 1980
Gérard SCHMITT, F, Electronics Technician, 31. 8. 1980
Jacques OTTAVIANI, F, Laboratory Technician (Electronics), 30. 9. 1980
Michel DENNEFELD, F, Astronomer/Physicist, 30. 9. 1980
Maurice LE LUYER, F, Senior Optical Engineer, 30. 9. 1980
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Renate VAN DOESBURG, D, Secretary, 30. 9. 1980
Paul DE VOS, NL, Mechanic, 31. 10. 1980

ASSOCIATES

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Ian GLASS, EIR, 1. 10. 1980
Philippe VERON, F, 1. 10. 1980
Marie-Paule VERON, F, 1. 10. 1980

DEPARTURES

Europe

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Jacqueline BERGERON, F, 30. 9. 1980

FELLOWS

ARRIVALS

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Walter EICHENDORF, D, 1. 9. 1980
Uno VEISMANN, EW, 1. 10. 1980
Harald WALDTHAUSEN, USA, 1. 11. 1980
Hélène SOL, F, 1. 12. 1980
Joachim KRAUTTER, D, 1. 12. 1980

DEPARTURES

Europe

Guillermo TENORIO-TAGLE, MEX, 31. 8. 1980
Jeremy A. SELLWOOD, UK, 30. 9. 1980
Danielle-Marie ALLOIN, F, 14. 9. 1980
Daniel KUNTH, F, 30. 9. 1980
Hans R. DE RUITER, NL, 30. 9. 1980
Jean SURDEJ, B, 30. 9. 1980
Eduardus ZUIDERWIJK, NL, 30. 9. 1980

Optical and Radio Studies of Supernova Remnants in the Local Group Galaxy M33

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W. M. Goss, Kapteyn Astronomical Institute, Groningen

The discovery of the first supernova remnants in M33 was made on material from a medium-size telescope but the subsequent detailed investigation involved the use of some of the largest optical and radio astronomy facilities in the world. Eventually, a complete study of these objects will improve our understanding of the stellar population and of the interstellar medium of that galaxy.

1. The Optical Search

At the present time about 130 extended galactic non-thermal sources have been classified as remnants of supernova explosions. Of these, only 30 have an identified optical counterpart, which, depending on the environment of the supernova and the age of the remnant, may consist in a few, faint filaments or in a nearly complete shell. The discrepancy between radio and optical identifications is due to galactic absorption and quite naturally has led optical astronomers interested in the subject to look in nearby extragalactic systems, where absorption conditions may not be so extreme. In the early seventies Mathewson and Clark pioneered this type of work by searching in the Magellanic Clouds. They started from a list of non-thermal radio sources, noting that in the shock ionized gas which is responsible for the optical emission, the strength of the [SII] emission lines at $\lambda\lambda 6717-6731$ is about equal to that of Hα, whereas in radiatively ionized nebulae they are one order of magnitude fainter. This effect is now understood from models of shocked radiating and cooling gas where temperature stratification can give rise to emission from a wide range of ions of differing ionization potential.

By observing at the position of the radio sources in Hα and [SII] light, Mathewson and Clark (*Ap. J.* **180**, 725, 1973) were able to identify 14 SNR on the basis of strong [SII] emission. In 1976 one of us, S. D., then working in the Asiago Observatory of the University of Padova in collaboration with Benvenuti and Sabbadin, started a similar search in the Local Group Sc galaxy M33 (Fig. 1). At the distance of 720 kpc, the Crab Nebula would appear stellar-like and an older remnant like IC443 measure a few arcseconds. High angular resolution was required to identify a shell structure when possible, to separate the remnants from nearby HII regions and to lower the background emission from the galaxy in order to observe faint features. For M33 there was no list of non-thermal radio sources to start with, but fortunately the angular ex-