Such a small field is not sufficient to counteract the effects of differential rotation, therefore it cannot be the main cause of formation and persistence of the spiral arms (Wentzel, Woltjer). However there are some local effects where magnetic effects play an important role. Fujimoto and Miyamoto developed magnetohydrodynamical models of helical fields in spiral arms. The importance of magnetic fields in the interstellar medium has been stressed by many authors. Review articles on the dynamics of the interstellar medium were written by Spitzer, Pikel'ner, and by Field. According to Pikel'ner the spiral arms are in magnetohydrodynamic equilibrium, and the arm thickness is determined by the pressure of the magnetic field and cosmic rays. This equilibrium is unstable, thus the gas breaks into clouds.

There are two basic models of interstellar clouds. In one (Field *et al.*) the major role is played by the gas pressure. The gas is heated by subsonic cosmic rays (Pikel'ner, and others) and cooled by collisional excitation and ionization of hydrogen and helium.

In the second model (Parker and Lerche) the magnetic pressure is considered larger than the pressure of the gas. The system gas-magnetic field is subject to a universal Rayleigh-Taylor instability. We can consider a hydromagnetic self-attraction, which is 10 times larger than the gravitational self-attraction and produces the clouds.

As regards the origin of the magnetic fields of our Galaxy, Parker ascribed it to interstellar turbulence and differential rotation. He proved that any inital weak field reaches at least 1 μG in 10^9 yr. The opposite view, of a primordial magnetic field, has been supported by Thorne.

The effects of non-gravitational forces (magnetic fields, turbulence and cosmic ray pressure) on the motion of interstellar gas around the center of the Galaxy have been estimated by Penston *et al.* They find that the gas lags behind the stars by a velocity of the order of 3 km s^{-1}.

The motion of cosmic rays in a random magnetic field was studied by Jokipii, and by Jokipii and Parker. Lerche and Parker studied also the bulk motion of the cosmic ray gas in our Galaxy, by taking moments of the collisionless Boltzmann equation. Hydromagnetic waves excited by cosmic rays were studied by Lerche and by Wentzel. Evidence for the existence of such waves comes from the scintillations of pulsars.

Weltzel found how the magnetic field of the clouds is separated from the general magnetic field. The influence of a magnetic field on the stability of the galactic disk was considered by Tassoul, and Aggarwal and Talwar. A magnetic field has a stabilizing effect.

The dynamics of cosmic rays were reviewed by Parker, and by Meyer.

The scattering of cosmic rays by waves is more important than the scattering by magnetic inhomogeneities (Fermi mechanism). The interactions between cosmic rays and Alfvén waves were investigated by Kulsrud and Pearce.

According to Ginzburg and Syrovatskii cosmic rays are mainly galactic, while according to the Burbidges and Hoyle they are universal, and according to Sciama they extend throughout the local group of galaxies. We have evidence that the electron component of cosmic rays is probably galactic, as well as protons and heavier nuclei with energies up to about 10^{15} eV, while the highest energy cosmic rays are probably extragalactic.

We have not discussed abundances, composition, and other properties of cosmic rays. A large number of papers on cosmic rays can be found in the Proceedings of the Tenth International Conference on Cosmic Rays (*Canadian J. Phys.*, **46**, no. 10), and the Fourth Texas Symposium on Relativistic Astrophysics.

G. CONTOPOULOS
President of the Commission

REPORT OF THE COMMITTEE OF "SELECTED AREAS"

Progress of research

Introductory notes

At the IAU Prague meeting it was considered desirable to continue to report on work performed in the Kapteyn Selected Areas (below referred to as SA) and other similar fields, as those belonging to the Parenago, Shajn and Cleveland plans, cf. also the main report of Commission 33.

A more detailed version of the present Report, including references to published work, will be distributed to those specially interested.

Photometry

At the Abastumani Observatory, Chuadze has determined photographic *B* and *V* magnitudes for 4000 stars in SA 25, 48, 50, 73, 75, 97, 99, and 122. Kalandadze has continued her work in Fields III and IV of the Parenago Plan and will publish a catalogue for about 8000 stars in Taurus; Metrevili will publish similar data (photographic *UBV* and spectral types) for 3000 stars. In co-operation with the Golosseievo Observatory a development of the Parenago Plan with photometric studies of regions centered at open clusters has been initiated; a catalogue of *B* and *V* magnitudes for 12000 stars by Voroshilov *et al.* has been published.

Papers dealing with *RGU* photometry have appeared from Basel for SA 51 (W. Becker) and SA 54 and 57 (Fenkart); catalogues will appear later. Landolt (Baton Rouge) is establishing *UBV*-sequences in the *V*-range 10·5 to 12·5 for the 0°-zone of SA; observations have begun at the Kitt Peak Observatory in SA 92–96, 98–109, and 113–115. King (Berkely) has completed his *BVR* photometry in SA 51, 57, and 68. Schmidt-Kaler (Bochum) has at ESO in Chile initiated photoelectric observations of 20 stars down to magn. 9 in each of 107 extended southern SA for calibration of quantitative spectral observations. From Bonn is reported that Geyer had made *UBV*-measurements for 18 standard stars in SA 157 in the *B*-range from 7·8 to 15·7, and Seggewiss for 22 stars brighter than $V = 14{\cdot}5$ in SA 87 (to be used as standards for Schmidt plates).

Rybka (Cracow) has reduced anew the previously reported Crimean photometry for SA 1-139. For Rybka's scheme of pairs of stars near *V*-magnitude 7·5, 9·0 and 10·5 in SA 1–43 Abuladze has started observations at the Abastumani Observatory. Pronik and Sharapova (Crimea) have published pg-magnitudes and colour indices for 1500 stars in a Shajn field at 18^h54^m, $+5°0'$. Urassin (Engelhardt, Kazan) reports on work by him, Tochtasjev and Dubjago; photographic *UBV* data are ready for about 10000 stars in SA 26–28.

T. Elvius (now in Lund) continues the measurements of plates for southern SA. For this programme Ardeberg observes photoelectric sequences at ESO in Chile, beginning with SA 92, 165, 188, and 200. Lyngå made in Australia photoelectric observations for about 70 stars in SA 201, 202, 204, and 205. For SA 195 Sarg, Roslund, and Engver have made photographic *UBV* photometry. Bigay (Lyon) reports that the photoelectric *UBV* determinations for O, B, and A0 stars have been continued; for SA 40 and 49 results will soon be published, for SA 64, 74, 87, and 110 the measurements are complete. Bigay adds that a similar programme has been commenced in four Cleveland fields.

Priser (Naval Obs., Flagstaff) has started a new SA-programme for photoelectric *UBV*. Sequences of 5 to 6 stars from the central star (8–10 magnitudes) down to 16 or 17 magnitude will be measured in SA 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, and 114. Grigorieva and Rostshina (Sternberg, Moscow) have determined photographic *B* and *V* for 830 stars in a Shajn field at 19^h32^m, $+22°5$, and Uranova (also Sternberg) similar data in Parenago field I. From Steward Obs., Tucson, is reported that B. J. and P. F. Bok have determined *UBV* sequences for SA 169 and 205, and that Schreur makes four-colour photometry (Strömgren type) photoelectrically and photographically in Sa 27, 47, 56, and 108.

From Uppsala is reported by Oja that photoelectric and photographic observations have been commenced in SA 32, 55–58, 80, and 81 with special emphasis on late-type giants; Häggkvist and Oja have given photoelectric results for 38 stars in SA 17, and 18 stars in Sa 8. From the Vatican Observatory (Castel Gandolfo) is reported that all plates have now been assembled and reductions initiated for SA 28, 54, 106, and 107. Roman (Washington) reports that she has completed photoelectric *UBV* photometry for 764 stars in the previously listed SA (*Trans. IAU*, **10**, 504, 1960); similar work has been performed also for SA 161, 164, 167, and 185. Zonn (Warsaw) has in collaboration with Kraskiewicz and Serkowski started photographic observations with the Schmidt telescopes at Torun and Mount Stromlo for a catalogue of galaxies in SA; as a by-product magnitudes of faint stars will be obtained.

Proper motions

Murray (Greenwich Obs., Herstmonceux) reports that work on improving the proper motions in the northern SA is in progress. Modern plates to match all the Radcliffe plates are being taken with the 26-inch refractor at Herstmonceux. When the programme is complete, there will be a total of eight plates covering an interval of 50 to 60 yr in most of the 115 areas. In addition a series of 170 plates on many northern SA have in recent years been taken with the 26-inch refractor to match plates taken with the same telescope, when at Greenwich, for photometric purposes during 1914 to 1920.

Radial velocities and spectral types

At Abastumani, Haradze and Bartaya are performing two-dimensional classification to magnitude 11·5 in SA 1–45. To magnitude 13 similar work is done by Chuadze for SA 25, 48, 50, 73, 75, 97, 99, and 122, and by Metravili in the Parenago region III. Such work is also planned for the open cluster fields, mentioned in the section on photometry.

The Haute-Provence and Marseille programmes have been continued; for SA 8 an investigation by M. Barbier is ready. T. L. Evans (Radcliffe, Pretoria) determines radial velocities and spectral types for 30 late-type stars in SA 141.

For SA and similar fields spectral determinations are also performed at the Bochum, Lund, Sternberg, and Uppsala observatories, and by Miss Roman, in connection with the photometric programmes mentioned above. Upgren (van Vleck, Middletown) has just compiled a finding list for stars of types B8–F0 in SA 28, 54, 106, and 107.

Radio astronomy

Kerr (College Park, Maryland) reports on 21-cm hydrogen observations made at Green Bank for SA 1–163, and at Pereyra, Argentina, for SA 164–206 and an overlapping strip. The central points, and four points stepped off one beamwidth, were observed for each SA. When fully reduced, these observations will provide data at a grid of points over the whole sky for systematic studies of the distribution and flow pattern of the nearby hydrogen, and for detailed comparisons with the wealth of optical data available in the SA.

T. ELVIUS
Chairman of the Committee