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Infrared Synchrotron Diagnostics as a New Perspective Direction in the Physics and Technology of Accelerator Experiments

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The methods and detectors for nondestructive diagnostics and study of charged particles of bunches or beams (electron, electron-ion, proton) are submitted in this paper. The methods of based on the use of relativistic particles synchrotron radiation in a wide spectral range, from the ultraviolet to the far long-wave infrared region [1, 2].

Methods for measuring and estimating the energy, number of charged particles (current) and geometrical parameters (cross-section) of beams in ring accelerators using synchrotron radiation are reviewed, together with the information-measuring systems designed to detect synchrotron radiation and realize these methods.

The practical possibilities of infrared synchrotron methods and systems of diagnostics are demonstrated for the example of the low-energy (electron energy $E = 2.5 - 20$ MeV, electron orbit $R = 40 - 4$ cm) electron-ion ring accelerator. The synchrotron radiation spectrum that is used mainly in the infrared region (wave length range > 1 mkm). The detection systems incorporate specially designed infrared-optical elements: a high-vacuum window of optical ceramics (analog IRTRAN) and broad-band, long-focus optical channels. The radiation is detected in the spectral region $0.3 - 45$ mkm by infrared detectors operating at low temperature or room temperature. Results are presented on the measurement of the number of electrons in the bunch, the equilibrium radius and dimensions of the small cross section of ring bunch, and the angular divergence of the synchrotron radiation relative to the median plane of the ring bunch.

References

- [1] A.A.Maltsev, M.A.Maltsev - Atom. Energy. 80 (3) 1996. P. 190.
- [2] A.A.Maltsev, M.A.Maltsev - Techn. Phys. 42 (4) 1997. P. 378.

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