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BUDKER INSTITUTE OF NUCLEAR PHYSICS (BINP) – COMPLEX OF ELECTRON-POSITRON COLLIDERS VEPP-4 AND VEPP-2000

BUDKER INSTITUTE OF NUCLEAR PHYSICS (BINP) is the largest Russian academic institute, one of the world's leading research centers in the field of particle physics, accelerator physics and technology, synchrotron radiation sources, free-electron lasers, high-temperature plasma physics, and controlled thermonuclear fusion. Some ideas and developments that determine the state-of-the-art accelerator science and technology were proposed and implemented at BINP.

BINP has a long history of experiments with colliding beams (VEP-1, 1963).

The VEPP 4 - VEPP 2000 complex is the only Russian complex of installations with colliding beams. The physical and technical parameters of the VEPP-4-VEPP-2000 **complex** enable set-up of world-unique experiments. The results and methods developed are widely used at scientific research organizations, both Russian and foreign, e.g., the masses of elementary particles measured with world record accuracy are used for description of the fundamental properties of the matter and thus are important information for the world scientific community.

In addition to High Energy Physics research, the complex is involved in experiments using synchrotron radiation extracted from the installations VEPP-3 and VEPP-4M. Beams of synchrotron radiation are used in experiments on properties of materials, nanostructures, explosive processes, catalytic reactions, and biological objects. The results of these experiments are applied both to the fundamental research and to technology.

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Instruments:	**Domain and object of research: PSE; ENE**
Name of the instrument or the technique used	**Brief description of the Instrument or of the technique used**
The complex of the electron-positron colliders VEPP-4-VEPP-2000	The BINP complex **VEPP-4 and VEPP-2000** includes two electron-positron colliders: VEPP-4M with the particle detector KEDR and VEPP-2000 with the detectors CMD and SND, as well as the multifunction electron/positron storage ring VEPP-3. VEPP-4M has started the program at it's high energy range of 5.2 GeV with resonance depolarization system for precise energy control. VEPP-2000 with new BINP injector and upgraded booster started data taking in all energy range of 160–1000 MeV with a luminosity increased in a factor of 2-5. Round beams concept gives the luminosity enhancement at VEPP-2000. Novel technique ("beamshaking") for effective emittance control allow to suppress flip-flop effect and increase beams intensity at middle energies. The idea of essentially homogeneous electromagnetic calorimeter in the detector KEDR on the basis of liquefied krypton, was realized for the first time in the world. The synchrotron radiation is extracted from the installations VEPP-3 and VEPP-4M. Nuclear physics experiments on an inner gas target are also going on. An inner gas target is a high-intensity jet of gas (hydrogen or deuterium), injected directly into the vacuum chamber of the VEPP-3 storage ring. Controlling the polarization of the atoms of the target gas and analyzing the scattering of electron beam on the target, one can obtain unique information about the structure and properties of the proton. Currently, such experiments cannot be conducted on any other cyclic accelerator in the world. **Reference:** Current Status of the VEPP-4 Accelerator Facility. Physics and technique of accelerators: https://link.springer.com/article/10.1134/S1547477120070067