**Ultracentrifuge Optima**

**Equipment:** *Ultracentrifuge Oprtima XPN-100* for separation of nanomaterials

**No. of Equipment: UFCH16**

**Responsible coordinator:** Ing.Jiří Rathouský CSc.

**Name of Institution:** J. Heyrovsky Institute of Physical Chemistry of the ASCR, v. v. i.

**Address of Institution:** Dolejškova 2155/3, 182 23 Prague 8, Czech Republic,

**E-mail:** jiri.rathousky@jh-inst.cas.cz

**Telephone:** +420 26605 3945

**Homepage:** http://www.jh-inst.cas.cz

**Contact person:** Radek Žouželka M.Sc.

**E-mail:** radek.zouzelka@jh-inst.cas.cz

**Telephone:** +420 26605 3080

**Equipment Description**

**Description of equipment:**

The ultracentrifuge is a [centrifuge](https://en.wikipedia.org/wiki/Centrifuge) optimized for spinning a rotor at very high speeds, capable of generating acceleration as high as 1 000 000 [g](https://en.wikipedia.org/wiki/G-force) (approx. 9 800 km/s²).

It can also be used for [gradient](https://en.wikipedia.org/wiki/Gradient) separations, in which the tubes are filled from top to bottom with an increasing concentration of a dense substance in solution.

Specifications and technical features:

Larger sample size can be used

No optical read-out collect fractions and analyse them after run

Less pure sample can be used

Step-by-step zonal/CF operation screens

User defined programs

Remote monitoring and control

Exportable run logs and electronic signatures

Speed/temperature vs. time plot

Maximum speed: 100,000 rpm

Maximum RCF (*x* g): 802,400

Speed control: ± 2 rpm of set speed (above 1,000rpm)

Set temperature: 0 to 40°C

Ambient operating range: 10 to 35°C

Accel/decal: 10/11

Drive cooling: air-cooled

Refrigeration system: thermoelectric – no CFCs, ODCs

Sound level: <51dBA

**Specification of expertise relevant to NanoEnviCz workpackages:**

**WP3**a,c-h **WP4**a,b, **WP5**c, **WP6**a,e, **WP7**b,h, **WP8**f,

**Detailed description of expertise**

**Please, specify the main research topics connected with equipment**:

Powerful method for characterizing solutions of macromolecules and an indispensable tool for the quantitative analysis of macromolecular interactions

Separation of variety of nanomaterials (several nanometers)

**Please, specify the secondary research topics connected with equipment**:

Provides useful information on the size and shape of macromolecules in solution with very few restrictions on the sample or the nature of the solvent

**Keywords describing research area:**

ultracentrifuge; rotor; density gradient; preparative centrifugation; conventional centrifugation

**Competence**

**Relevance for applied and industrial research:**

Analyze the solution behavior of a variety of molecules in a wide range of solvents and over a wide range of solute concentrations

To analyse interactions between macromolecules and to unravel physico‐chemical properties like mass and size of such particles.

**Relevance for fundamental studies:**

Sedimentation equilibrium provides first-principle, thermodynamic information about the solution molar masses, stoichiometries, association constants, and solution nonideality

Ultracentrifugation (AUC) is especially useful for the characterization of small nanoparticles (1-10 nm)

**Comments**

The fundamental requirements for the sample are: 1) that it has an optical property that distinguishes it from other solution components, 2) that it sediments or floats at a reasonable rate at an experimentally achievable gravitational field and 3) that it is chemically compatible with the sample cell. The fundamental solvent requirements are its chemical compatibility with the sample cell and its compatibility with the optical systems