

John A. Koropchak

1976 A.B., Chemistry, Lafayette College, Easton, Pennsylvania

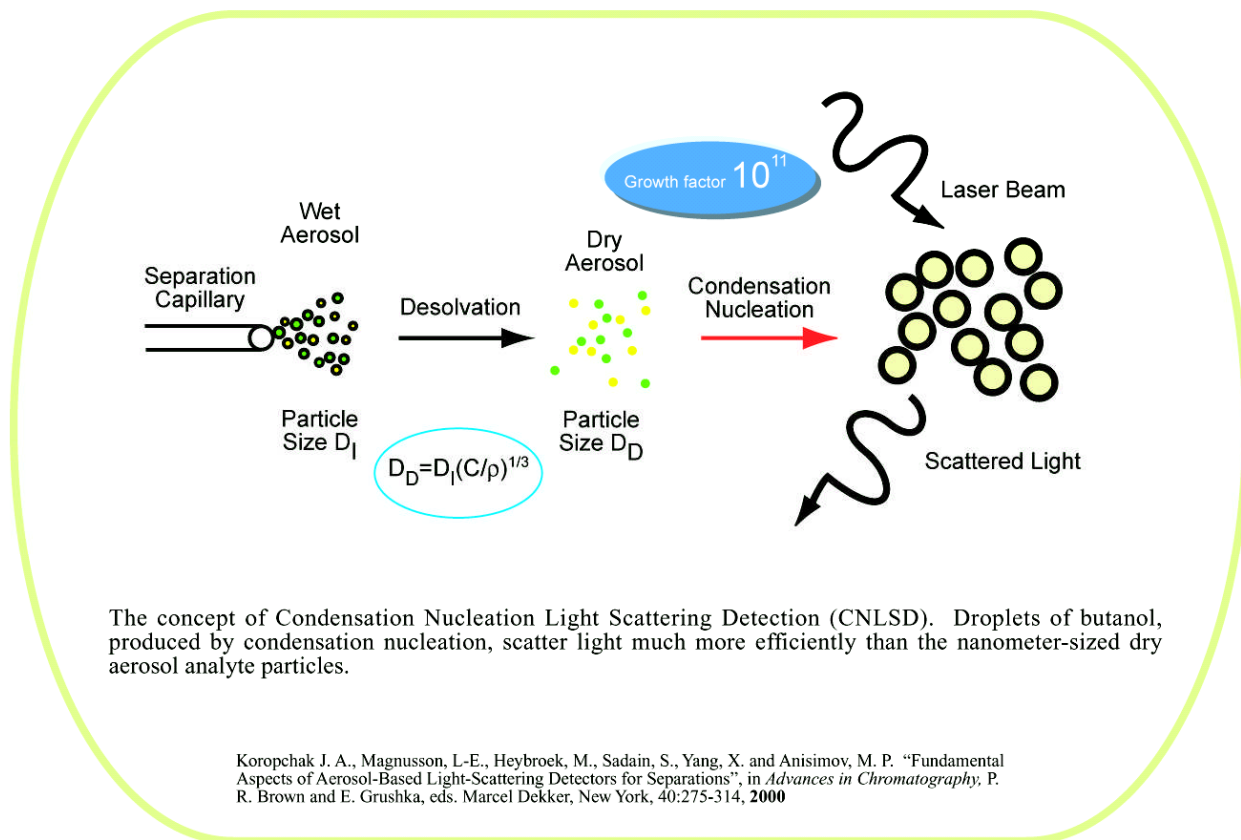
1980 Ph.D., Analytical Chemistry, University of Georgia, Athens, Georgia

Research areas: spectroscopy, atomic spectrometry, chromatography detectors, single molecule detection

Current area of research emphasis:

Sensitive, universal detection for separations using condensation nucleation light scattering

Condensation Nucleation Light Scattering Detection (CNLSD) is a sensitive, universal detection technique for separations which precludes the need for derivatization of non-chromophoric species.<sup>1,2</sup> CNLSD involves conversion of the effluent of the separation to an aerosol, followed by selective vaporization of the mobile phase, leaving the less volatile analytes behind as dry particles in the gas-phase. This process results in the dispersion of the analyte sample into millions of discrete aliquots, and is followed by condensation of a saturated vapor onto the dry analyte particles to grow them from as small as 2-3 nanometers in diameter to droplets which can be 10 micrometers, or more:



Condensation nucleation provides huge increases in particle mass ( $>10^{11}$ ) that tremendously enhance the scattering intensities per scattering site, providing a means to obtain high sensitivity. We have already demonstrated application of CNLSD for sensitive, universal detection with most liquid-phase separations, including liquid chromatography, and capillary electrophoresis. Current efforts relate application of CNLSD systems for the analysis of environmental and biological samples, commercialization of CNSLD, and fundamental studies toward development of principles for CNLSD systems with enhanced properties (e.g., single molecule detection).

With the support of Phase I and II small business innovation research (SBIR) grants from the National Institutes of Health, in collaboration with Fluid Measurement Technologies, Inc. (Vadnais Heights, MN), CNLSD has been successfully commercialized for use with HPLC (<http://news.siu.edu/news/December05/122105kj5132.jsp>). CNLSD is manufactured and marketed by our other partner, Quant Technologies (Blaine, MN), and made its commercial debut at the 2007 Pittsburgh Conference. More information about the commercial CNLSD can be found at: <http://www.cnlsd-quant.com/>.

Our current research into condensation nucleation for detection is focusing on capillary separations and approaches to advancing the sensitivity and other capabilities of CNLSD.

#### Selected Recent Publications:

1. J. A. Koropchak, S. Sadain, X. Yang, L. Magnusson, M. Heybroek, M. Anisimov and S. L. Kaufman, "Nanoparticle Detection Methods for Chemical Analysis", *Analytical Chemistry*, **71**, 386A-394A (1999). (INVITED)
2. L-E. Magnusson, J. A. Koropchak, M. P. Anisimov and V. M. Poznjakovsky, "Correlations for Vapor Nucleating Critical Embryo Parameters" *J. Phys. Chem. Ref. Data*, **32**, 1387-1410 (2003), also chosen to appear in *Virtual J. Nanoscale Sci. & Tech.*, **8** (4), <http://www.vjnano.org/nano/> (2003).
3. J. You and J. A. Koropchak, "Condensation Nucleation Light Scattering Detection with Ion Chromatography for Direct Determination of Glyphosate and Its Metabolite in Water", *J. Chromatogr.*, **989**, 231-238 (2003).
4. J. You, M. Kaljurand and J. A. Koropchak, "Direct Determination of Glyphosate in Environmental Waters using Capillary Electrophoresis with Electrospray Condensation Nucleation Light Scattering Detection", *J. Environ. Anal. Chem.*, **83**(9), 797-806 (2003).
5. Q. Lu and J.A. Koropchak, "A Corona Discharge Neutralizer for Electrospray Aerosols Used with Condensation Nucleation Light Scattering Detection", *Analytical Chemistry*, **76**, 5539-5546 (2004).