Tiny bubbles with huge potential

By BRUCE JUDDERY

"Bubston" is a word that might have an odd ring to it in English — but it has the potential to turn science, and especially biology, on its head.

It is shorthand for "bubbles stabilised by ions" and if the word's inventor and co-discoverer of the reality behind it (if that reality can be proven) has it right, it could provide insights into phenomena that have puzzled science for generations.

Dr Nikolai Bunkin, of the Institute of General Physics in Moscow, and Dr Olga Vinogradova, of the Institute of Physical Chemistry of the Russian Academy of Science, in the same city, believe they have discovered the presence in salt water of hitherto unsuspected, persistent sub-microscopic gas bubbles, no more than 10 nanometres in diameter.

A nanometre is one-millionth of a centimetre. So the bubbles, if they exist, are too small to be detected individually by even the most advanced apparatus.

But they do form clusters, or so the Russians believe. And it is these that the two scientists believe they have detected using a new small-angle laser scattering technique.

The trouble is that even the clusters should not exist.

"Uncharged bubbles should dissolve immediately in liquid, according to conventional ideas," Dr Bunkin said. "The pressure inside the bubble is very high and the gas should escape from the bubble.

"So we assume the bubble is charged. This is very strange. According to the principles of conventional physical chemistry, because ions [negatively charged particles] should escape across the liquid-gas boundary and there should be an increase in surface tension and a more rapid dissolution of the bubbles.

"But we really know little about water and we found, experimentally, absolutely opposite results."

The head of the Australian National University's Department of Applied Mathematics, Professor Barry Ninham, with whom the Russians have been collaborating during three weeks in Canberra, said: "If it's right, it's mind-blowing in terms of the interface between physics and biology."

"The question is: is it right or is it wrong?"

Professor Ninham, whose department is checking the Russians' experiments, has arranged to have their work subjected to rigorous scrutiny by the scientific community. He has arranged for them to address a scientific conference in Stockholm next month, and Dr Bunkin a conference on colloid science in Japan in September.

While they have been in Canberra he has been re-working papers with them that will appear in international journals.

"I'm not making any claims but I am helping because it is so controversial and deserves to be debated," he said.

Physics, he believes, is poised to contribute to biology.

"There is this terrible tyranny of disciplines, with the biologists treating the physical sciences as an enabling science," he said. "Molecular biology really depends upon advances made by physicists like Watson and Crick [discoverers of the organisation of DNA], Pauling, Bernal and Huxley."

Though water is crucial to life, there is no place in conventional theory for the presence of the bubbles which Dr Vinogradova and Dr Bunkin believe they have discovered.

Dr Bunkin gained his first clues to the presence of the bubbles when laser signals through apparently clear water gave unexpected results.

"It was clear to me that I should propose some mechanism to explain it," he said.

That mechanism was the clustered sub-microscopic bubbles the scientists believe they have identified experimentally.

Once they were identified, an explanation for their longevity had to be found. The tentative answer was bubston.

The Russians have worked with Professor Ninham in seeing if their work and that of he and his colleagues on hydrophobic — water-repellant — forces in nature fit together. "If we are right about hydrophobic forces this will change biophysics dramatically," Dr Vinogradova said, "because all biophysics has neglected dissolved gas, and all biophysics involves hydrophobic surfaces."

Professor Ninham believes that the work might contribute to the creation of new scientific paradigms that could provide missing clues to biology and biochemistry.

"Even if it is wrong and their results are attributable, say, to impurities, the impurities are ubiquitous and so are the effects of dissolved gas, so far ignored in any kind of theory," he said.

Picture: GRAHAM TIDY

Dr Bunkin and Dr Vinogradova at the ANU yesterday.