negatively charged, the remaining part of the atom would become a positively charged "ion," which could then be drawn to a negatively charged plate, detected and counted.

Thus, they sought to design a two-step process. The first step was highly selective, intended to search out only the one type of atom of interest and begin the process toward electron removal. The second step was to remove the electron in a process called ionization.

The total process is called "resonance ionization" because it works only when the laser light is perfectly tuned in harmonic resonance with the amount of energy required by the selected electron transition. Further, because the light passes invisibly by all other species of atoms and their electrons, this technique provides an extraordinary degree of selectivity.

While the concept of resonance ionization was well established before the Seed Money research and, in fact, had been demonstrated earlier on atoms of helium, the technique was not practical because it required the use of extremely powerful lasers. Further, it was highly skewed. In the case of helium, for example, only one-tenth of one percent of the total energy required for the two step process went into the all important first step. The remainder went into the ionization step.

The thrust of the 1975 Seed Money project was to explore ways to make RIS more practical. They hoped to use a commercially available, low power laser to accomplish selectively the first step, followed by some other technique to complete the second.

For purposes of study, they decided to pick one of the easiest elements in the Periodic Table to ionize, cesium (helium is the most difficult), on which their proposed techniques were most likely to succeed. They tried several ionization schemes, including the use of electromagnetic fields and collisions with other gas molecules under pressure. Both worked. They established for the first time the feasibility of one-atom counting.

As is often the case in basic research, however, the real breakthrough was more subtle and unexpected. In the process of working out their theories and setting the procedures for their experiments, they learned a great deal about photophysics. Using this new knowledge, they came up with a number of schemes whereby low power lasers could be used to achieve *all* the steps necessary, without resorting to other and more cumbersome techniques.

Since then, RIS schemes using low power lasers have been developed for all elements in the Periodic Table except two, helium and neon. These elements still require lasers of a type not yet commonly available. Importantly, with subsequent refinements to RIS, accomplished by the 1978 and 1982 Seed Money projects, nearly every atomic species of scientific or commercial interest, from gaseous to solid form, can now be investigated with an unprecedented degree of selectivity and precision.

In response to intense interest on the part of potential users, a commercial firm was established to develop and manufacture RIS instruments and provide related advisory services. RIS won two IR-100 Awards from *Research & Development* magazine and is the subject of a number of United States patents.

The RIS technique has so profoundly altered the field of atom science that literally hundreds and perhaps thousands of researchers across a multitude of disciplines are now conducting or contemplating experiments not possible a decade ago. The new knowledge produced as a result will undoubtably be equally impressive.

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