Our results show that the hypothesis of Mitra is unable to explain all the features of active nitrogen. The strong emission of the first negative system must result from a recombination of the doubly ionized ions N_2^{++} and electrons. To account for the increase of the Goldstein and selected bands of the second positive system, we must assume an atomic recombination. Likewise the selective emission of the first positive system is made clear by the Carion and Kaplan mechanism in which one molecule of nitrogen ($A^3\Sigma, v=0$) is excited by an atom of nitrogen (3D) or (2P). It is possible also that the emission of the bands at $B(v'=6)$ results from the interaction with the $^1\Pi$ -level. For example, it would not seem possible to admit that the emissions of the first and second positive systems follow the same mechanism of capture of electrons:

since it would not account for the great variations in their relative intensity with the experimental conditions.

The remarkable features of active nitrogen seem rather to result from the fact that this diatomic molecule is like an inert gas that permits many reactions between atoms, ions and electrons.

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Reported Radioactivity of Osmium

For some time it has been known that two isobars which differ by unity in atomic number cannot both be stable, except for a possible influence of the neutrino if its mass has a positive value at rest. A search for radioactivity among the existing pairs of isobars led to the announcement¹ of K -electron capture in osmium (Os^{187}) with a half-life of about 3×10^8 years. However, a recent paper on beta-stability² contains the following remark: "The reported radioactivity of Os^{187} has recently been questioned, with indications that Re^{187} instead is radioactive"³. It seems worth pointing out that some time ago another argument had thrown strong doubts on the view that osmium is radioactive.

This conclusion rests on data, contained in a paper by Noddack and Noddack⁴, which gives the results of rhenium determinations in a number of minerals. These authors find the rhenium content of osmiridium from New South Wales to be about 10^{-5} per cent and of a sample from the Urals about 10^{-4} per cent. From what is known about the rocks from which the platinum ores originate, we may take 2×10^8 years as a fair estimate of the age of most of the osmiridium samples investigated by Noddack. Osmiridium usually contains between 30 and 50 per cent osmium, and 1.64 per cent of the latter is Os^{187} . Therefore, if the rate of radioactive decay quoted above were correct, osmiridium should contain about $\frac{1}{4}$ per cent rhenium. Although the figures for the rhenium content and for the age of

osmiridium are admittedly inaccurate, the discrepancy of at least something like 10^4 is sufficiently large to prove that, if K -electron capture occurs in osmium, the half-life must be several orders of magnitude longer than that given by Lougher and Rowlands.

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The Metallic State

IN the development of the resonating-valence-bond theory of metals, it has become evident that the characteristic structural feature of metals is the possession by each atom or each of many atoms in the metallic phase of an extra orbital (the 'metallic orbital'), in addition to the orbitals normally occupied by electrons. This metallic orbital permits the unsynchronized resonance of electron-pair bonds from one interatomic position to another by the jump of one electron from an atom to an adjacent atom, leading to great stabilization of the metal by resonance energy, and to the characteristic metallic properties.

For example, in lithium each atom has one valence electron, permitting the formation of an electron-pair bond for each pair of atoms. These bonds resonate among alternative positions, mainly the eight positions between each atom and its eight nearest ligands. If each atom were required to remain neutral, by retaining its valence electron, the stabilization through the permitted synchronized bond resonance,

molecule, would be relatively small. Much greater stabilization results from unsynchronized resonance

an additional orbital on the atom receiving an extra bond. The electronic conductivity and other characteristic properties of metals may be described in terms of the transfer of the positive and negative charges from atom to atom accompanying the resonance of the valence bonds.

The resonance energy resulting from use of the metallic orbital in metals outweighs the energy of repulsion of adjacent non-bonded atoms and permits the co-ordination number of atoms to be greater than the number of valence electrons or bond orbitals. Thus tin, with 14 outer electrons and 9 stable orbitals (five $4d$, one $5s$, and three $5p$; or hybrids of them), may place electron pairs in five orbitals and single electrons in the other four; this quadrivalent tin, with no extra orbital, forms the essentially non-metallic phase grey tin, with the diamond structure (co-ordination number 4, non-resonating single bonds). However, a metallic orbital can be made available by placing six unshared electron pairs in six orbitals, and single electrons in two orbitals. This bivalent