Questioning Astrophysics and Revealing Connections between Stellar Ignition, Luminous Galactic Structures, Dark Matter, Galactic Jets, and the Origin of Heavy Elements

by

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Ours is a time of unparalleled richness in astronomical observations, but understanding seems to be absent throughout broad areas of astrophysics. Among some groups of astrophysicists there appears to be measured degrees of consensus, as indicated by the prevalence of so-called "standard models", but in science consensus is nonsense; science is a logical process, not a democratic process, and logical connections in many instances seem to be lacking. So the question astrophysicists should ask is this: "What's wrong with astrophysics?" Finding out what's wrong is not only the necessary precursor to righting what's wrong, but will open the way to new advances in astrophysics. Toward that end, one may question the basic assumptions upon which astrophysics is founded, as well as question the approaches astrophysicists currently employ. Here I describe one methodology and provide specific examples, the details of which are set forth elsewhere [1-3]. In doing so, I place into a logical sequence seemingly unrelated astronomical observations, including certain Hubble Space Telescope images, so that causal relationships become evident and understanding becomes possible; as a consequence, profound new implications follow, for example bearing on the origin of diverse galactic structures and the origin of the heavy elements.

The purpose of science is to determine the true nature of the Universe and its components, which may be entirely different from making models that do not have to be true. In the past, the varied morphologies observed among galaxies have been explained on the basis astrophysical models which are based upon assumptions. Beneath the assumptions explicitly set forth for the particular models, there are underlying implicit assumptions, which some may not even recognize as assumptions. One of the most fundamental implicit assumptions underlying much of astrophysics pertains to the ignition of stars, specifically the assumption that stellar thermonuclear fusion reactions ignite automatically as a consequence of the heat generated by the gravitational collapse of dust and gas during star formation. I question the validity of that assumption.

By mid-1938, the thermonuclear reactions thought to power stars were reasonably well understood [4]. Those reactions are called "thermonuclear" because temperatures on the order of a million degrees Celsius are required for ignition. At the time it was assumed that million-degree temperatures would be attained as a consequence of the gravitational collapse of dust and gas during star formation; in mid-1938, no other energy source for that purpose was known. That concept of stellar ignition has persisted to the present although clearly there were indications of a problem. In 1965, Hayashi and Nakano from their calculations realized that thermonuclear ignition temperatures of a million degrees Celsius would not be attained during stellar formation [5]. The reason for the difficulty of attaining million-degree temperatures is that heating produced by the in-fall of dust and gas is off-set by radiation from the surface, which is a function of the fourth power of temperature. Rather than questioning the underlying astrophysical assumptions, for more than four decades astrophysicists just tweaked their modeling parameters, such as opacity and formation rate or added additional *ad hoc* hypotheses, such as a shock-wave induced sudden flare-up [6, 7].

The over-riding reason for questioning science in general and astrophysics in particular is that the circumstances and knowledge at the time certain concepts were formulated may have changed with subsequent discoveries. In the case of stellar ignition, in December 1938 nuclear fission was discovered. Then, nuclear fission chain reactions were discovered, and proven capable of powering atomic bombs (A-bombs) and proven capable of igniting hydrogen bombs (H-bombs), thermonuclear fusion bombs. Every thermonuclear fusion H-bomb is ignited by its own nuclear fission A-bomb, and every H-bomb detonation is an experimental verification that nuclear fission chain reactions can ignite thermonuclear fusion reactions (Figure 1). In a paper published in 1994 in the *Proceedings of the Royal Society of London*, I suggested that stars, like H-bombs, are ignited by nuclear fission chain reactions [8].

Figure 1. Experimental proof that nuclear fission chain reactions can ignite thermonuclear fusion reactions: H-bomb “mike” test Eniwetok Atoll 31 Oct 1952.

There is a profound and fundamental difference between stellar thermonuclear ignition by nuclear fission, as I have suggested, and the previous idea which had its beginnings before nuclear fission was discovered. With the pre-1938 idea, which continues to the present, the implicit assumption is that stars automatically ignite as a consequence of the heat produced through the in-fall of dust and gas during formation. My 1994 concept of stellar thermonuclear ignition by nuclear fission, on the other hand, leads to the possibility of stellar non-ignition, to dark stars, which will remain dark stars unless and until seeded with fissionable elements.

Half a century ago, Burbidge, Burbidge, Fowler and Hoyle set forth the basis for thinking that the chemical elements are synthesized in stars, with the heavy elements being formed by rapid neutron capture in the supernova phase at the end of a star's life [9]. I do not question the possibility of heavy element formation in supernovae, but I question B^2FH's lack of generality. The conditions and circumstances at galactic centers appear to harbor the necessary pressures for producing highly dense nuclear matter and the means to jet that nuclear matter out into the galaxy (Figure 2) where it seeds dark stars that it encounters with fissionable elements, turning dark stars into luminous stars.

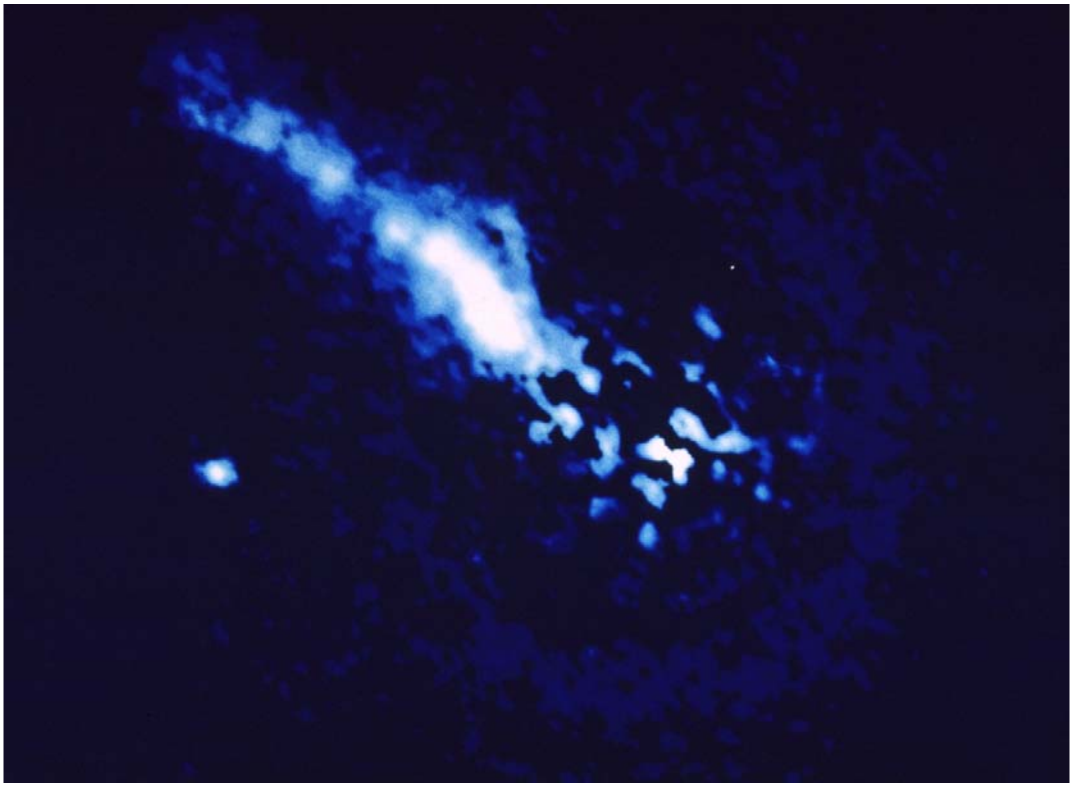

Figure 2. Hubble Space Telescope image of 10,000 light year long galactic jet from galaxy 3C66B with ambient galaxy light digitally removed.

Consider a more-or-less spherical, gravitationally bound assemblage of dark (Population III) stars, a not-yet-ignited dark galaxy. Now, consider the galactic nucleus as it becomes massive and shoots its first jet of nuclear matter into the galaxy of dark stars, igniting those stars which it contacts. How might such a galaxy at that point appear? I suggest it would appear quite similar to NGC4676 (Figure 3) or to NGC10214 (Figure 4).

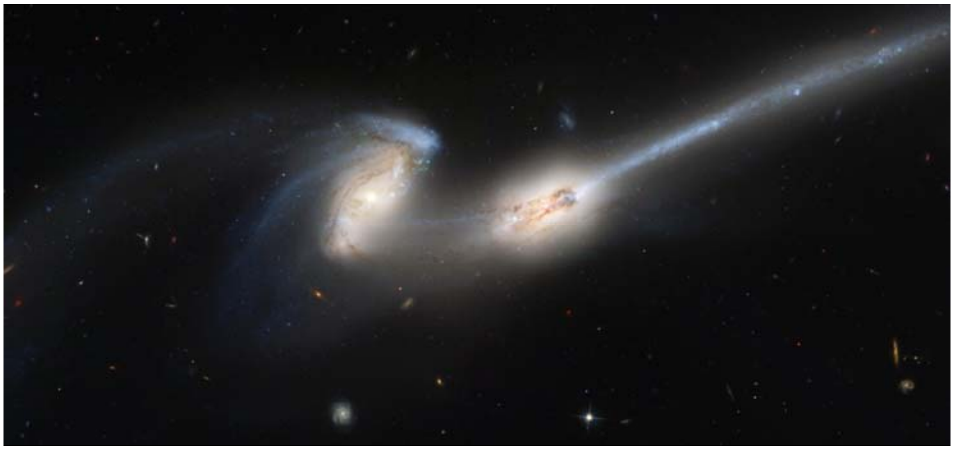

Figure 3. Hubble Space Telescope image of galaxy NGC4676.

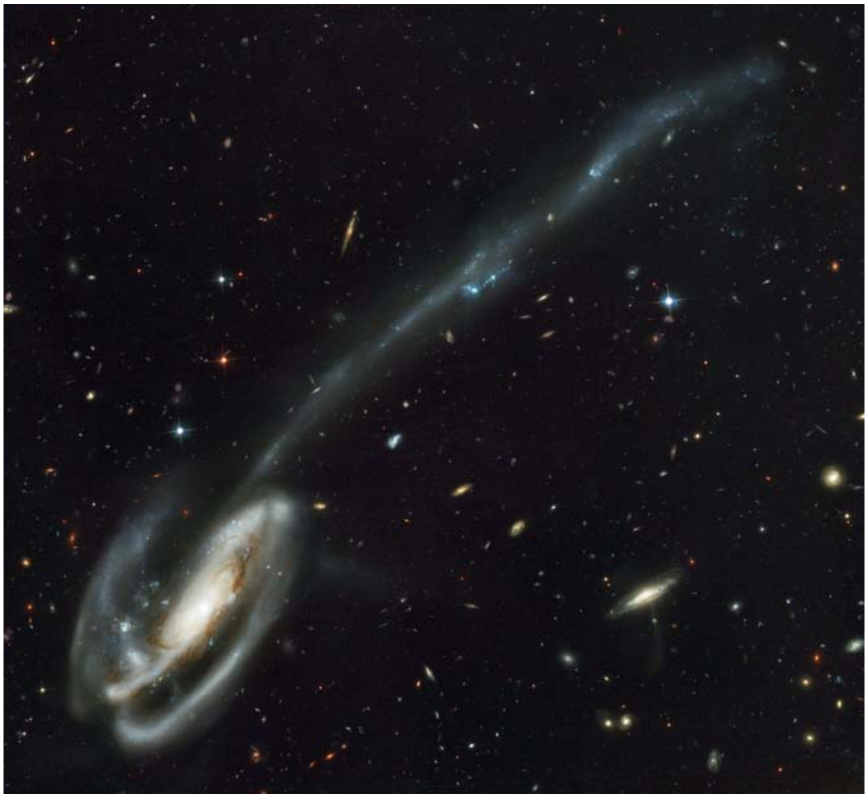

Figure 4. Hubble Space Telescope image of galaxy NGC10214.

I suggest that bi-polar jets are principally responsible for igniting the luminous star distributions of barred galaxies, such as NGC1300 (Figure 5).

Figure 5. Hubble Space Telescope image of galaxy NCG1300.

Bars are often found in disc galaxies [10]. Both bars and the arms of spiral galaxies, such as M101 (Figure 6), possess morphologies which, I suggest, occur as a consequence of galactic jetting of fissionable elements into the galaxy of dark stars, seeding the dark stars encountered with fissionable elements, thus making possible ignition of thermonuclear fusion reactions.

Figure 6. Hubble Space Telescope image of galaxy M101.

And what of the dark matter necessary for dynamical stability? It is just where it must be to impart rotational stability to the luminous structure [11].

When scientific thinking is underlain by mistaken understanding, further progress is not possible, like trying to navigate the streets of London with a Chicago city map. Really good scientists will understand the importance of questioning astrophysics and will appreciate finding mistakes because righting underlying mistakes will inevitably open the door for new advances and discoveries. But some will try to bury or to suppress the idea of questioning astrophysics; these are the science-barbarians whose ignorance, arrogance and lack of scruples cheat the astrophysics community and the taxpayers who support astrophysics. Between the two extremes are a great many well meaning astrophysicists who may not yet have learned how to make advances and discoveries instead of making models. For those, questioning astrophysics may be like taking the first step through a portal into a different realm of science where fundamental discoveries await. For those individuals, I have described a methodology and a variety of techniques that can be employed to aid in making discoveries [2].

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