Bubble-Filament Paradigm of Star Formation and Dust Evolution in Disk Galaxies

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Recent observations of NGC628 and other face-on disk galaxies by *JWST* have revealed outstanding chains of bubbles on spiral arms in those galaxies, which seem to justify "the bubble-filament paradigm" for the formation of molecular clouds and stars studied for our Milky Way Galaxy. This paradigm emphasizes the importance of the formation and evolution of magnetized filamentary molecular clouds on the bubbles in the processes of star formation. Theoretical and observational investigations have provided convincing evidence for the formation of molecular cloud cores by the gravitational fragmentation of filamentary molecular clouds on the bubble. The paradigm self-consistently explains the origins of the stellar initial mass function and the angular momenta of astronomical objects in addition to the other basic properties of star formation process such as the star formation rate and efficiency. On the other hand, *Herschel HiGAL* survey has shown that all the luminous star cluster forming clouds are exclusively identified as hub-filament systems where the central roundish hub region consists of numerous short filamentary clouds. Thus, the formation and evolution of hub-filament systems determines the formation of massive stars and star clusters in our Galaxy. Using these findings, we can create a framework to describe the evolution of dust grains in our Galaxy and other disk galaxies where heavy chemical elements in the halos play important roles.