Messier Star forming Regions

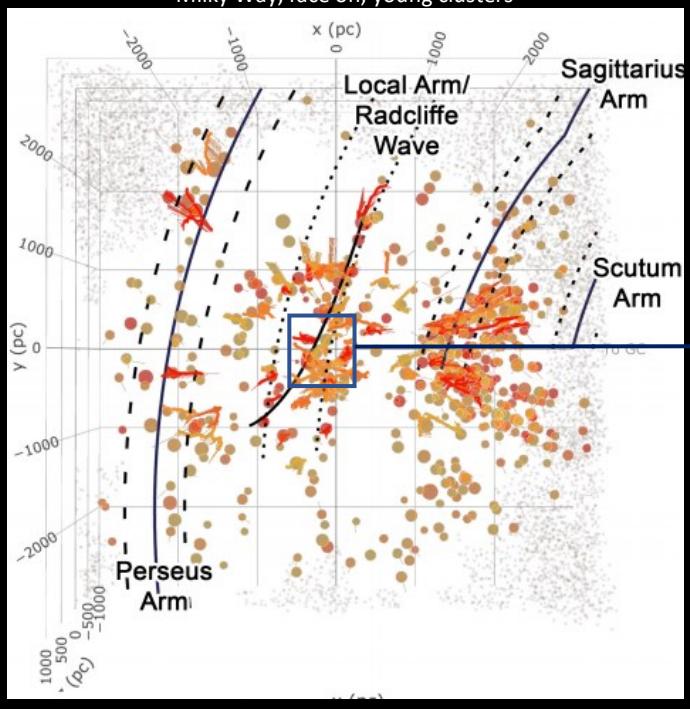
I'd like to start this Messier run with a view of the young star-forming regions in Messier's catalog.

A 5-dimensional analysis (3D position + 2D velocity) based on *GAIA* DR2 data out to a distance of 3 kpc from the solar system has shown that stars appear to be born out of extended (~200 pc long, ~10 pc wide) filamentary strings of gas and dust rippling in the galactic plane. These primordial star-forming filaments are then slowly dispersing their new-born stars into weakly bound stellar string populations, which with time are partly gravitationally contracting into individual clusters and associations, slowly migrating into the galactic field, yet retaining characteristics of their comon origin (HR-diagram, co-moving dynamics).

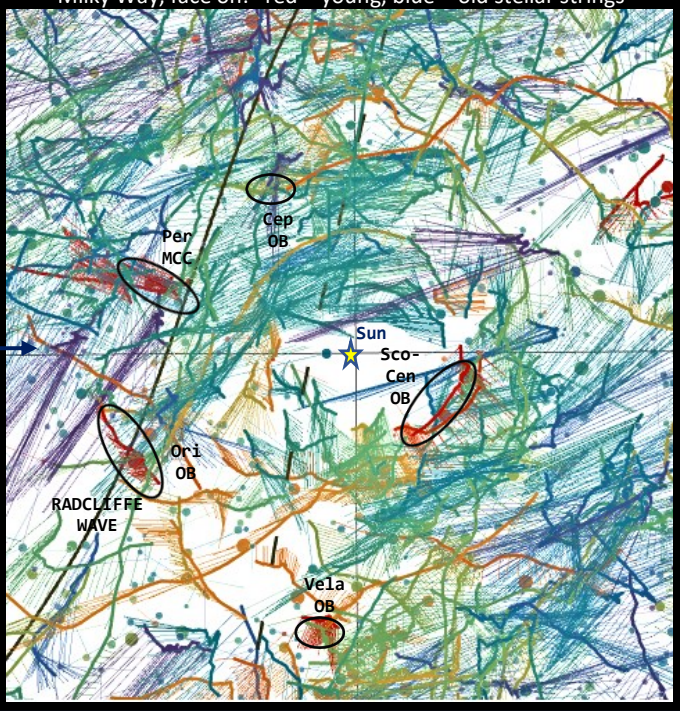
The spiral arms we see in the Milky Way today are transient structural features of dynamic galactic resonance on a timescale of a few 100 Myr. Our own Local Arm as well as the inner Sagittarius and outer Perseus arms were formed only ~100 Myr ago. The recent *GAIA* analysis has identified no less than 8292 star-group filaments out to 3 kpc from our solar system, most originating in the three spiral arms but others being attributed to older galactic arms. Analysis of the strings show that the Sagitarius Arm has shifted 500 pc closer to the galactic center since its formation and now show many young strings of stellar groups, while the Perseus Arm has been more stationary with a lull in the star forming activity in the past 25 Myr.

In our Local Arm, the 2.7 kpc long molecular gas structure named the "Radcliffe Wave" shows stellar clustering of young age (<12 Myr) all along its length, and the clusters are still compact and isolated into a few stellar filaments; More strings may however be forming, as molecular gas is infalling into clouds with new stars. As I've discussed previously in this CRF-thread, the Radcliffe Wave features the most prominent bright stars in the solar neighborhood in a ring-shaped band across the celestial sphere, but as can be seen from the pictures below, this "Gould's Belt" is in reality made up of filaments with "condensations", most notable the Radcliffe Wave (Orion OB, Perseus MCC, Cepheus OB) and the Vela-Sco/Cen Blue Stream (UCL OB, Vela OB).

Milky Way, face on, young clusters



Milky Way, face on: red = young, blue = old stellar strings



Untangling the Galaxy I: Local Structure and Star Formation History of the Milky Way.
Untangling the Galaxy II: Structure within 3 kpc
Marina Kounkel, 1 Kevin Covey, 1 and Keivan G. Stassun2, arXiv.
https://arxiv.org/pdf/2004.07261.pdf

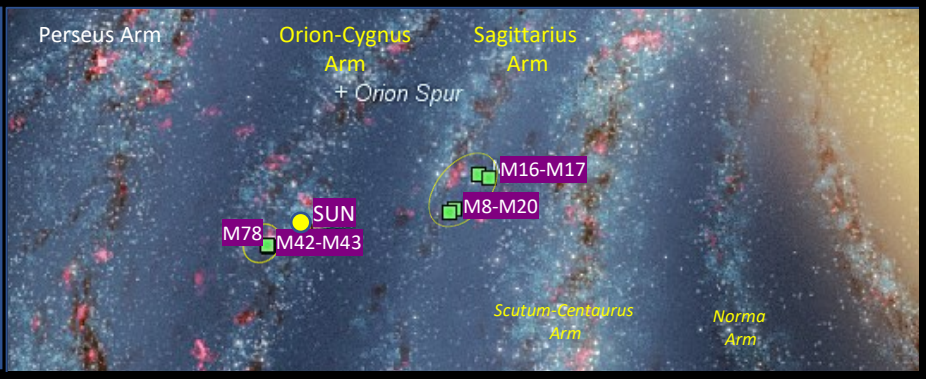
The Messier Milky Way nebulae locations fall in two groups: The nearby (~400 pc) nebulae towards the outer part of our local Orion-Cygnus spiral arm (M42-43-78) plus the more distant (~1.500 pc) nebulae in the next inner Sagittarius spiral arm (M16-17-20-8), towards the galactic bulge.

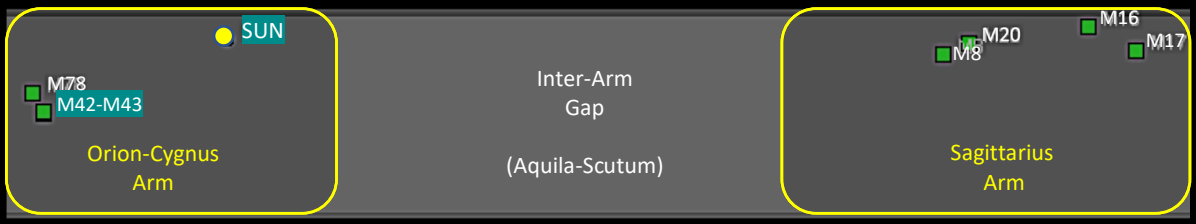
1: MESSIER MILKY WAY NEBULAE

1: Emission & Reflection Neb. [4+3]

M	NGC	Name	Sagittarius Arm
M08	N6523	Lagoon-Neb.	Sgr
M16	I4703	Eagle-Neb.	Sgr
M17	N6618	WhiteSwan-Neb	Sgr
M20	N6514	Trifid-Neb	Sgr

M	NGC	Name	Orion-Cygnus Arm
M42	N1976	Great Orion	Ori
M43	N1982	De Marian	Ori
M78	N2068	Frosty Window	Ori





Name	Type	Const	Gal Lon	Gal Lat	Lum (#Sun)	Size LY	Dist LY	Age 1000 YR
M42, NGC 1976, Orion Nebula	EN, OC	Ori	209,1	-19,4	14399	40 x 28	1600	3000
M43, NGC 1982, De Marian Nebula	EN	Ori	208,9	-19,3	362	9 x 7	1600	3000
M78, NGC 2068, Frosty Window Nebula	RN	Ori	205,3	-14,3	13	4 x 3	1600	2000
M16, NGC 6611, Cr 375, Eagle Nebula	EN, OC	Ser	17,0	0,8	9461	13 x 13	6500	5500
M17, NGC 6618, Cr 377, Swan Nebula	EN, OC	Sgr	15,1	-0,8	3759	22 x 22	6800	1000
M20, NGC 6514, Cr 360, Trifid Nebula	EN, OC	Sgr	7,0	-0,3	595	46 x 42	5400	300
M8, NGC 6523, Cr 362, Lagoon Nebula	EN, OC	Sgr	6,0	-1,2	4189	136 x 61	5200	200