Introduction

Many astronomers study the brightest stars whose distribution is likely a great circle or belt. By the eighteenth century, William Herschel used star-gauging to study our Milky Way system and noticed the OB stars were not distributed uniformly (e.g., Whitney, 1971; Herschel, 1912). Gould (1879) found out the special distribution of the OB stars that were aligned along a great circle, which might not belong to the galactic plane and inclined about 20 degree. Since then, it is known as the Gould Belt.

The investigation of the Gould Belt

In the beginning, the Gould Belt was discovered by eyes, but many researches have studied the Gould Belt to check its existence in different investigating methods. The OB stars were observed easily and were made use of investigating the Gould Belt much frequently. The stellar motion of the O – B5 stars in the solar neighborhood has been discussed by Blaauw since 1956. Because the OB associations tend to expand, the expansion model is proposed at the time to estimate the age of the Gould Belt and the calculated age is 50 Myr (Blaauw, 1956). From the O – B5 stars of HD catalogue with absolute magnitude less than 6.5, investigation showed two kinds of the age of the selected OB stars. Age of B type stars might be about 90 Myr, which was different from considering OB association alone, if the stars were assumed to be an expansion model (Lesh, 1968). In fact, the age of the Gould Belt is in a range between 30 Myr and 90 Myr according to the different studying ways. If the Gould Belt is investigated about the stars occupying in the Gould Belt, the age will almost be 30 Myr ~ 50 Myr (Blaauw, 1956; Palouš, 1985; Westin, 1985; Comerón *et al.*, 1994). Moreover, the age will be 30 ~ 90 Myr (Olano, 1982; Westin, 1985; Frogel & Stothers, 1977; Comerón & Torra, 1990; Pöpel *et al*., 1994; Lesh,

1968) when counted by the expansive rate.

In 1973, the Gould Belt were thought to be with relation to the HI structure "feature A" by Lindblad and the research continued looking for the relation between the neutral gas and the Gould Belt. The Gould Belt was known to locate on the similar region of the "feature A" (Lindblad *et al.,* 1973, 1997, 2000) and was discovered that the region contained stars, dust, HI, and the molecular clouds (e.g. Pöppel & Olano, 1982; Sandqvist, Tomboulides, Lindblad, 1988; Taylor & Dickman, 1987). In addition to the components of the Gould Belt, some researchers studied its kinematics and the interrelationship between galactic plane and the Gould Belt. When (X, Y, Z) and (U, V, W) of 280 OB stars are calculated, the horizontal velocity gradient $\partial U/\partial X$ is about 40 km/sec/kpc and infects these stars should be from Cassiopeia – Taurus and Scorpio – Centaurus groups (Eggen, 1961, 1975). Besides, Comerón (1999) provided that the motion of the Gould Belt still has a vertical component of the velocity. The kinematical properties of the Gould Belt affect not only the velocity gradient but also the stars in the solar neighborhood. When the kinematics of the stars in the solar neighborhood is discussed, the kinematics of the stars with $R > 600$ pc is determined by the galactic differential rotation and that with $R \leqq 600$ pc is lead by the Gould Belt (Torra *et al.,* 2000). The character could be known by calculating the Oort's constants, too (e.g. Uemura *et al*., 2000; Mignard, 2000; Dehnen & Binney, 1998; Tsioumis & Frick, 1979; Comerón, 1999; Olano, 1982). Furthermore, some researches didn't study the early type stars but late type ones. The F-M stars, which exhibit active x-ray, were observed in x-ray by Guillout *et al.* (1998). The research shows that the Gould Belt can be discussed with late type stars from different x-ray energy. Besides, the investigation proposed that the Gould Bet could be a ring disk with small inner radius rather than a belt. The distribution of the Gould Belt drawn by Guillout *et al.* (1998) is Fig 1.

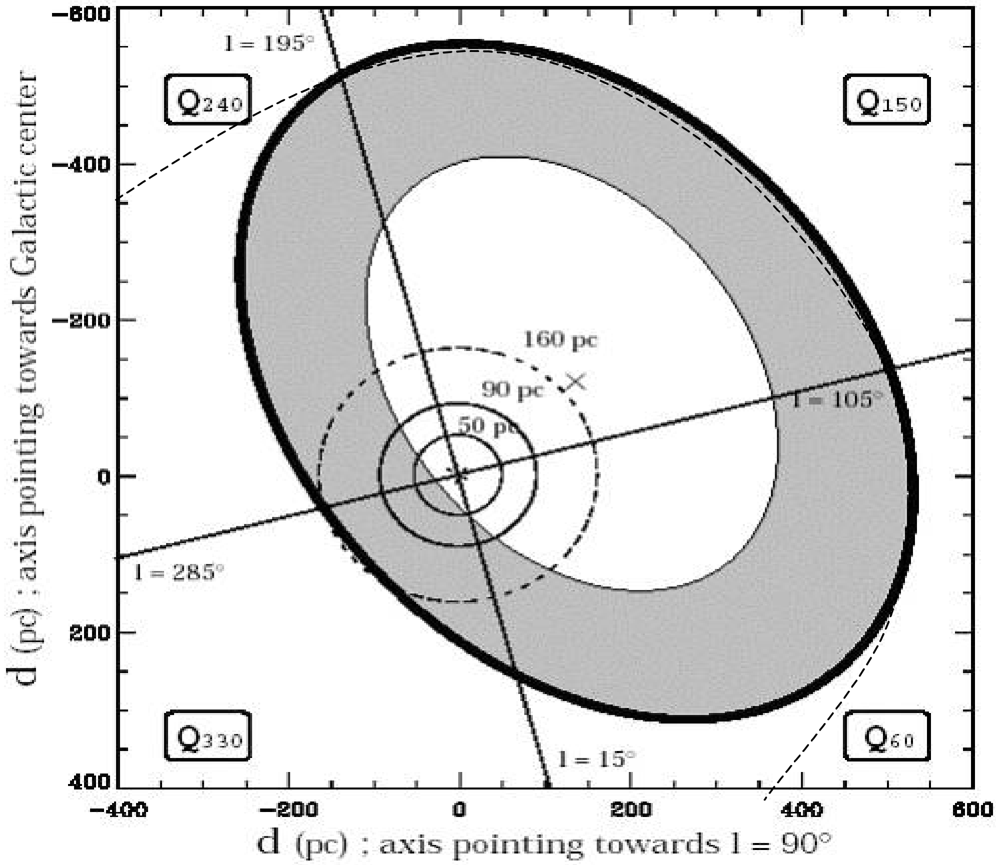

Fig 1: The diagram of the Gould Belt projected on the XY-plane is from Guillout *et al.* (1998) according to the observation. The edge is defined by molecular clouds and the dash line is about 500 pc from the sun.

The mark is the position of the sun, which doesn't locate at the center of the Gould Belt. The semi-major is 500 pc in the direction of l = 15°/195°, and the semi-minor is about 340 pc in the direction of l = 105°/285°

The distribution of the Gould Belt

Some results of inclining angle with respect to the Galaxy and direction of the semi-major axis of Gould belt are listed on table 1 and table 2. The inclining angle with respect to the galactic plane is pretty different due to the different observing method. According to the radio observation, the inclining angle of the gas in the Gould Belt region is larger than that of the stars belonging to the Gould Belt (Strauss *et al*., 1979).

The shape of the Gould Belt is not a circle or a ring due to the effect of galactic differential rotation, and the velocities of these stars belonging to the Gould Belt have changed their directions (e.g. Moreno *et al*., 1999; Torra *et al*., 1994). When the Gould Belt is projected in the sky, it seems to wind around the Milky Way. On the other hand, the projection of the Gould Belt on the XZ, or YZ plane shows an oblique belt or line and the length of the projective region won't be the same in the two planes.

Table 1: The inclination and deflection of the Gould Belt

l , d(*)	semi-major	semi-minor	notes
l = 131°, d = 166 pc	364 pc	211 pc	Olano (1982)
l = 150°, d = 140 pc	326 pc	157 pc	Lindblad *et al*. (1973)
l = 135°,	---	---	Westin (1985)
l = 127°,	---	---	Lindblad (2000)

*: *l* and d are direction and distance of the center of Gould belt from the sun, respectively.

Table 2: The parameters of the Gould Belt

φ °(*)	l°(+)	The way for studying	notes
~ 18	25	The distribution of the complex O – B5, luminous supergiants, clusters and associations	Frogel & Stothers (1974)
22	---	The photometric and motion of 500 early type stars brighter than Mv = -1	Eggen (1975)
19	---	The positions and velocities of the selected younger A type and B type stars from CDS	Poluš (1985)
19 (age < 2×10^7) 14 (age = 3 ~6×10^7)	---	The spatial and kinematics of the O – A0 stars with age younger than 6×10^7 years	Westin (1985)
12.5	---	CO emission survey of 622 molecular clouds in the solar neighborhood	Taylor *et al.* (1987)
22.3	---	Selecting 2483 stars with V < 7.5 discussed the characteristics and origin	Comerοn *et al.* (1994)
20	---	Analyzing 90000 A, F, G type dwarfs at an altitude over the Galactic plane lower than 300 pc	Fresnueau *et al.* (1996)
25	20	The X-ray luminosity of F – M type stars of the RASS – Tycho. (Data with Lx = $10^{29.5}$ ~ 10^{31} erg/sec which is commensurate with the age of Gould Belt are discussed.)	Guillout *et al.* (1998)
16 ~ 22	---	The kinematical model and distribution of 6922 O- and B- type stars from Hipparcos Internal Proposal INC4060 completed with all the O and B survey stars	Torra *et al.* (2000)

* φ ：Direction of the semi-major axis

\+ l ：Inclining angle with respect to the Galaxy

The origin of the Gould Belt

The origin of the Gould Belt is still a puzzle. The most reasonable explanations are single explosive event like super novae explosion (e.g. Blaauw, 1956, 1991; Lesh, 1968; Olano, 1982; Sandqvist *et al*., 1988; Torra *et al*., 2000; Lindblad, 1973, 2000), the impact of a large high velocity cloud (e.g. Comerón & Torra, 1992,1994), and the effect of spiral density waves (e.g. Lindblad et al., 1973).

Blaauw (1956) pointed out that the dynamics of the Gould Belt might be contained a property about expansion. In addition, it may be also has a rotational property with a pretty large initial angular momentum and velocity dispersion, which make the Gould Belt gravitationally unbound and continue expanding (Lindblad *et al*., 1968, 1997). To explain the expansion and rotation model, the Gould Belt could be assumed as forming from a giant molecular cloud with a rotation axis (e.g. Fresneau *et al*,.1996; Lindblad, 1997; Comer0n, 1999). When a shock wave passes this giant molecular cloud, young stars emerge in the region where is the Gould Belt (Fresneau *et al*., 1996). Stars in the region would keep some properties of the shock wave due to the explosion, and they look like moving outward.

On the other hand, the rotation axis is not perpendicular to our galactic plane, so Comerón (1999) proposed that it would be high velocity clouds give rise to the Gould Belt forming. When a high velocity cloud collides on the galactic disk, the shock would advance the shocked gas. The shock front breaking down the equilibrium is the main reason of the star formation in the shocked region. The model can explain the expansion of the Gould Belt reasonably, too.

No matter what the origin is, it can make a shock wave concentrate the interstellar medium then cause the formation of molecular clouds and stars by gravitational instabilities (e.g. Palouš, 1994; Mc Cray, 1987; Elmegreen, 1989,1992). Furthermore, the Gould Belt still exists without damping in present by the balance of the radiative force and the ambient interstellar pressure (Elmegreen & Chiang, 1982; Moreno *et al*., 1999; Franco *et al*., 1991).

The motion and the relation between the Gould Belt and Oort's constant

Because the observed stellar motion is affected by the solar motion and the galactic rotation, the component of solar motion should be removed for reflecting the relation between the stellar motion and the galactic rotation purely. After the solar motion is deducted from the stellar motion, the galactic rotation could be described by using Oort's constants. Apparently, different kinds of the stars would be calculated to different Oort's constants. The equation and the process about the calculation of Oort's constants have been listed in the appendix.

The kinematical properties of the Gould Belt affect the local system strongly. A research shows that the kinematics of the O, B stars in the solar neighborhood is affected by the galactic rotation, Gould Belt, OB associations, and the open clusters (Torra *et al*., 2000). Stars lie on the position less than 450 pc from the sun have expressed the existence of the Gould Belt by Lesh (1968). The Gould Belt would not extent out of 600 pc (Tsioumis & Fricke 1979) and then the calculation of Oort's constants should be divided into at least two parts based on the distance.

The Oort's constants from the research work of the Tsioumis and Frick show that:

A= 14.2 km/ sec/ kpc for radial velocity with $R < 450$ pc

A= -15.6 km/ sec/ kpc for proper motion with $R < 450$ pc

B= -26.5 km/ sec/ kpc with $R < 450$ pc.

But the values are different from 450 pc $\leqq$ R < 1300 pc that :

A = 13.1 km/ sec/ kpc , B = -13.2 km/ sec/ kpc,

which are similar to the angular velocity of the galactic rotation. The result shows the kinematical properties of the inner part of the galactic plane with many members of the Gould Belt become more complex.

This work

In this research work, the positions and kinematical properties of OB stars and A0 – A5 stars will be presented. If the edge of the Gould Belt could be indexed by early type stars, the late type stars might be used to index larger scale understanding of the Gould Belt. In the aspect of position, the Gould Belt could cross the disk plane of the Milky Way from the distribution of OB stars (for example: Westin, 1985; Poluš, 1985; Taylor & Dickman, 1987). The distribution of OB stars in the research shows similar belt region, but that of A0 – A5 stars just extends an unclear region blended with amounts of stars in the XYZ position diagram. If the A0V – A5V stars are chosen, the XYZ diagram would be seen a narrower oblique belt just like what is in the Gould Belt region of the OB stars. The better way is to find out the members of the Gould Belt by their different kinematical properties. From the vector point diagram of these selected OB stars, two groups are checked by eyes clearly, and one of them seems to be with relation to the members of the Gould Belt, but A0 – A5 stars don't show the same distribution. Besides, Oort's constants and the relation of kinematical properties between the Gould Belt and the Galaxy have been discussed later. When the XYZ coordinate is transferred to the Gould Belt system, the result of stellar distribution in the investigation doesn't consist of the model of the Guillout *et al*. (1998) entirely.