1 Introduction

For the observations of binaries, angular separation could approach to the diffraction limit of the telescope by mean of speckle interferometry method. Since turbulence structure was published at 1962 (Texereau, 1962), it was known that atmosphere distort images taken by ground based telescopes. The typical angular resolution of the optical observation is limited about 1″~2″ other than the diffractive limit of the telescope (ex. Labeyrie, 1970; Korff, Dryden, and Miller, 1972). In 1970, the French astronomer Antoine Labeyrie described a method whereby atmospherically induced blurring can be thwarted to obtain resolved detail down to the theoretical diffraction limit. Labeyrie's technique of "speckle interferometry" uses high-magnification, short-exposure snapshots to freeze out the instantaneous effects of turbulence and then applies mathematical techniques to remove these effects (Labeyrie, 1970). The method works best when the object being observed is simple in appearance and not too extended in size. Its limitations superbly match the needs for studying binary star systems, pairs of stars bound by their mutual gravitational attraction into elliptical orbits about a common center of mass. The speckle interferometric method is usually used for binary system with the angular separation less than 2″~3″ down to the resolution of the telescope (Gezari, Labeyrie, and Stachnik, 1972; Korff, Dryden, and Miller, 1972; Dainty, 1973; Liu and Lohmann, 1974; Knox and Thompson, 1974).

So many researchers have developed the speckle Interferometric method to measure the angular separation and the position for binary with freeze speckle pattern in term of 20 ms or less exposure time. McAlister hold series of observing program using 0.66-M telescope on McCormick observatory (1974) and 4-M telescope on Kitt Peak (1976) studied astrometry of binaries. From 1977 until 1998, group of CHARA (The Center for High Angular Resolution Astronomy) of Georgia State University, USA carried out the most scientifically productive program in astronomical speckle interferometry applied to the study of binaries. The development of instrumentation and algorithms to extend the power of speckle methods continues to be of high priority within CHARA. Thousands of accurate measurements of binaries, including more than 300 systems that had never been previously resolved, had been published, and these measurements almost observed with instrumentation at 4-m class telescopes in Arizona and Chile (ex. McAlister et al., 1989; McAlister, 1993).

When CCD cameras are used as speckle image detectors, more sensitive and digitized data make speckle interfrometry imaging of binaries are much cheaper for

small telescopes. In USNO, a speckle interferometric method for binary observation with 0.66-m telescope was developed since 1990 (Germain et al., 1994; Mason et. al., 2006). Furthermore, A 0.5-m telescope (Rutkowski, 2005) and a 1.52-m telescope in Calar Alto observatory, Spain (Docobo et al., 2007) also did very precise observations of small separation binaries.

In Taiwan, the first speckle interferometric observation of binaries was done in National Central University on 1992 (Li, 1993). A 61cm telescope was used to observe at least 4 targets (Antares, ADS 15971, ADS 1598, and Castor). The images were captured by an analog signal output CCD and were recorded with V8 tapes that were digitized by a frame grabber.

Webcams are common commercial cameras, and some types of them modified for astronomical imaging are released. Philip 840k webcam is chosen for our speckle observation, because it can be set to download with B/W RAW images. Furthermore, brightness, gain, gamma, high-pass filter, and shutter speed can be set in its control interface, and the pre-amplifier can be switch-off to make clearer images.

The binary program with the speckle Interferometric method at NTNU was developed since 2003. The typical cooled CCD cameras are not suitable because the shutters are not set in such high speed, 0.02s or less. However a webcam CCD is modified to satisfy the requirement of speckle observations, including high shutter speed, high frame rate, directly digital RAW images and B/W chip. There are three observations with speckle Interferometric technology. Firstly, the observation was carried using the 14-inch Schmidt Cassegrain telescope at the observatory located on the campus of NTNU on April, 2005, and two observations using the LOT on April 2006 and February, 2007 respectively

The distorted spatial information of binaries is processed by normalized 2D autocorrelation function. Pixel scale and orientation are calibrated with bright binaries Castor or double slits, and drift scan images.